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Ichthyoplankton Abundance and Diversity in the Eastern Gulf of Mexico

A report to the Bureau of Land Management
prepared under Contract No. AA550-CT7-28

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ABSTRACT

An ichthyoplankton survey, consisting of 17 cruises to the eastern Gulf of Mexico, was carried out from 1971-1974. Objectives of the survey were to determine the kinds and abundances of larval fishes, their distribution and diversity, and the relationship of their occurrence to environmental factors. From the egg and larval distributions, spawning areas and seasons were determined, and in some cases biomasses of adults were estimated. The surveys succeeded in providing important baseline data on the early life stages of fishes in the Gulf of Mexico. A total of 143,034 fish larvae were collected that included 91 families and 173 identified species. Most identified larvae were in the 10 most commonly collected families. The families Clupeidae and Gobiidae dominated larval catches at < 100 m deep stations while the Myctophidae were dominant at > 100 m deep stations. Annual abundances and mortality rates were estimated for the most common species. Adult biomasses of several species were estimated; pelagic fishes apparently have higher biomasses than demersal fishes in the eastern Gulf. There were no significant differences in ichthyoplankton diversity among years, seasons or between north and south sectors of the survey area; but diversity was significantly higher in offshore than in onshore zones. Effects of environmental factors on ichthyoplankton abundance were not clearly demonstrated but the modes and ranges of surface temperature, surface salinities and station depths where common species occurred were clearly defined. Positive affinities of some species with water of Loop Current origin, when it intruded into coastal areas, were demonstrated for several species. Future ichthyoplankton research in the Gulf of Mexico should emphasize the need to recognize many common, but presently unidentified, species and to apply this knowledge in analyses of ichthyoplankton at the community level, where environmental or exploitation effects are most likely to be noticed.

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EXECUTIVE SUMMARY

Planktonic eggs and larvae of fishes were collected on 17 cruises to the eastern Gulf of Mexico in 1971-1974. The survey area extended from latitude 24°45'N to latitude 30°15'N, encompassing the west Florida continental shelf and extending offshore to include continental slope and oceanic sampling areas. Objectives of the program were to determine the kinds and abundances of fish larvae and eggs as a means to understand the importance of the eastern Gulf of Mexico as a spawning area for fishes. Areas and seasons of ichthyoplankton occurrences were described and relationships of environmental variables to ichthyoplankton abundance were examined. Diversity and structure of the larval fish communities also were examined by both area and season. When possible, adult biomasses were estimated based upon estimated annual production of eggs or larvae and fecundities of the species involved. Summarized data and charted distributions of ichthyoplankton which are products of this research, are useful baseline information, to which future ichthyoplankton surveys in the Gulf of Mexico can refer.

A total of 143,034 larvae and 304,620 eggs were collected at 869 sampling stations during the surveys. Ninety-one families of larval fishes were identified, in which 161 genera and 173 species were included. The 10 most common families, in ranked order, were the Clupeidae (sardines and herrings), Gobiidae (gobies), Bothidae (left-eyed flounders), Myctophidae (lanternfishes), Serranidae (seabasses, groupers, sand perches), Carangidae (jacks, pompanoes), Synodontidae (lizardfishes), Ophidiidae (cusk eels, brotulas), Bregmacerotidae (codlets) and Labridae (wrasses). Two-thirds of all larvae that were collected were in those 10 families. Larvae of the Clupeidae (29,290 specimens) and Gobiidae (21,621 specimens) were most common and contributed 35.6% of the total larval catch. They were the dominant families of larval fishes in the eastern Gulf of Mexico in areas < 100 m deep. In areas > 100 m deep, the Myctophidae (7,223 specimens) were the predominant family of larvae. Larvae in some of the most common families (e.g., Gobiidae, Ophidiidae and Labridae) could not be identified to species, because larval stages of eastern Gulf of Mexico species have not been described.

A total of 59,701 larvae were identified to species, which is 41.7% of all larvae that were collected. Ninety of the 173 species that were identified were in the 20 most often collected families and those 90 species contributed 56,992 larvae, which is 95.5% of all larvae that were identified to species. Many more species than those actually identified are present as larvae in the eastern Gulf.

Four species of Clupeidae contributed 28,561 individuals to the collections. The most common clupeids were Spanish sardine Sardinella anchovia and Atlantic thread herring Opisthonema oglinum. Those two species also were the most common of all identified larvae collected during the surveys.

The 10 most commonly collected species of fish larvae in the eastern Gulf of Mexico were Spanish sardine Sardinella anchovia, Atlantic thread herring Opisthonema oglinum, round scad Decapterus punctatus, sand perch Diplectrum formosum, scaled sardine Harengula jaguana, dusky flounder Syacium papillosum, an undescribed codlet Bregmaceros Type B, the flounder Bothus robinsi, the gray flounder Etropus rimosus and a lightfish Maurollicus muelleri. These 10 species accounted for 46,637 larvae, which is 78.1% of all larvae identified to species. As in most animal communities, a relatively few species of larval fishes dominate the catches of eastern Gulf ichthyoplankton.

Annual abundances of larvae of some common species varied considerably from year to year. For 26 common species that were examined in detail most varied annually in abundance by factors ranging from 2.0 to 3.5 at sizes near metamorphosis. Some species, such as Sardinella anchovia and Bregmaceros Type A, were shown to vary annually by factors ≥ 20 times. The decline in abundance of larvae as lengths increased was a measure of apparent mortality rates. For the 26 species, only a single species, Bregmaceros Type B, could be shown to have significantly different apparent mortality rates among the years of the survey. Characteristic apparent mortality rates were associated with the kinds of larvae that were examined. Mortality coefficients, the magnitude of which are measures of the relative rates of mortality, increased among families in the following order: Clupeidae -- 0.3909; Gonostomatidae (lightfishes) -- 0.3947; Bothidae -- 0.4454; Bregmacerotidae -- 0.6244; Myctophidae -- 0.7313; Serranidae -- 0.8372; Scombridae (tunas and mackerels) -- 0.9651; Pomadasyidae (grunts) -- 1.0730; and Carangidae -- 1.0957. Sardine-like, long-bodied larvae, which probably grow in length at the fastest rates, have the lowest apparent mortalities while short-bodied, robust perciform larvae have the highest apparent mortality rates.

Biomasses of adults of a few of the commonest species were estimated based on egg or larval abundances and fecundities of spawning females. Only some clupeid species (e.g. Atlantic thread herring, Opisthonema oglinum, and round herring, Etrumeus teres) and the carangid Decapterus punctatus apparently have biomasses that exceed 100,000 metric tonnes in the eastern Gulf of Mexico. The biomass of the bothid Syacium papillosum is approximately 100,000 metric tonnes. A relatively large biomass (25,000-48,000 metric tonnes) of spawning bluefin tuna Thunnus thynnus was present during 1972 and 1973 in the survey area. From the biomass estimates that were made and available information on larval abundances of other species, it is probable that the total biomass of pelagic fishes in the survey area is between 1.5 and 3.0 million metric tonnes, while demersal species probably have an aggregate biomass less than 1.0 million metric tonnes. If the eggs of more species could be identified, and if fecundity estimates were available, the biomasses of more species could be estimated.

Largest catches of fish eggs and larvae were made in spring and summer. When the 94 most common species were considered, the mean number of species that occurred in cruises during each season was: winter -- 42.5 species; spring -- 57.2 species; summer -- 53.0

species; fall -- 54.3 species. The frequencies of individuals occurring in the various species were examined to determine the diversity of the ichthyoplankton community. There were no significant seasonal differences in larval diversity. Lowest diversity was recorded in summer when dominance of the community by abundant clupeid, bothid and carangid larvae was highest. Highest diversity was noted during fall when larval abundances were relatively low but numbers of species remained high.

Species diversity of ichthyoplankton did not differ significantly in 1971, 1972 and 1973. A mean diversity index value that measures species evenness for the three years was $J = .6927$. The index is the ratio of observed diversity to maximum possible diversity for the species being considered. The index value, with .95 confidence lies between .6528 and .7326.

The mean number of species collected on cruises was higher in the southern (48.2 species) half of the survey area than in the northern (40.4 species) half. Despite the differences in species present, there were no significant differences in mean diversity between the two sectors. Species diversity values were highest in the southern sector on 6 of 10 cruises.

There were significant differences in ichthyoplankton diversity between areas where depths were < 50 m and > 50 m. Diversity was highest at offshore sites. There were, on average, more species per station present at > 50 m deep sites (9.17 - 10.41 species) than at shallower sites (4.33 - 6.65 species). Speciose families such as Myctophidae, were present offshore as were many kinds of larvae (e.g. Bothidae and Serranidae) that are present in both shallow and deep areas of the eastern Gulf. The mean number of species per cruise collected at > 50 m sites was 44.8, but only 26.9 species per cruise were sampled at < 50 m deep stations. In addition to few species being present at shallow sites, the ichthyoplankton was dominated there on many cruises by a relatively few species, usually clupeids such as Atlantic thread herring O. oglinum.

Ichthyoplankton diversity did not differ between Sanibel Island (latitude $26^{\circ}30'N$) and Tampa Bay (latitude $27^{\circ}30'N$) transects that were sampled on 11 cruises. The mean number of species per station was 8.1 for the Tampa Bay transect and 8.2 for the Sanibel transect.

Simple correlation coefficients between the 94 most common species and environmental variables were calculated. There were no clear linear correlations between abundances of a kind of larva and surface temperature, surface salinity, station depth or zooplankton volume. The choice of environmental variables may not have been the best possible for this analysis. Relationships among the variables probably should not be considered as simple, linear correlations. Another factor that tended to confound the analysis was the presence of Mississippi River flood runoff during summer 1973, which caused abnormally low surface salinities in the eastern Gulf and which could not be adequately accounted for in the analysis that was used.

A second approach was used to relate the occurrence of common larvae to environmental factors. Occurrences of larvae were examined as the cumulative percentage frequency distributions of larval occurrences in relation to the environmental factors. In this way the modes and ranges of temperatures, salinities and depths where the larvae were most often collected were determined. Seasonalities of occurrence were often apparent in the temperature-occurrence data and depth zonation was apparent in the depth-occurrence data. The range of surface temperatures over which eastern Gulf of Mexico larvae were collected usually was broad (10-15°C), but most species were commonly collected only within a 5-8°C range. Depth distributions were variable. Some species, such as the round scad, D. punctatus, occurred at all depths that were sampled while others, such as some myctophids, occurred only at depths > 100 m; still other species, such as pigfish Orthopristis chrysoptera and some sciaenid larvae, were rarely found at depths > 20 m.

The Loop Current is an important feature of the eastern Gulf of Mexico circulation. Its potential effect on transport or entrainment of oceanic kinds of larvae onto the continental shelf was examined. There was evidence that the Loop Current does influence the distribution of some kinds of larvae. Of 14 species that were examined, 10 of them occurred more frequently than expected in shallow water when Loop Current water was present. But, only six of those species could be shown to be significantly, positively associated with Loop Current water. Species that showed significant Loop Current affinities were the myctophids Myctophum nitidulum and Diogenichthys atlanticus, the gonostomatids Gonostoma elongatum and Vinciguerrria nimbaria, and the bregmacerotids Bregmaceros atlanticus and Bregmaceros Type A.

Ichthyoplankton of the eastern Gulf is abundant and diverse. There are several species which serve to characterize the eastern Gulf habitat. Larvae that are particularly common and widespread, and which can serve as good reference species include the bothid flatfish Syacium papillosum, the carangid Decapterus punctatus and the serranid Diplectrum formosum. Other species of larval bothids also are key species in the eastern Gulf of Mexico and some clupeids like Sardinella anchovia or Opisthonema oglinum also fall into that category. For monitoring purposes the bregmacerotids should be included as key species, especially the two previously undescribed kinds, Bregmaceros Type A and Bregmaceros Type B, which occur consistently and in abundance at offshore sampling stations.

Results of this study have significantly increased our knowledge of the kinds and abundances of ichthyoplankton in the eastern Gulf of Mexico and they also have helped us to better understand some environmental conditions that are important to early life stages and for spawning populations of fishes in the region. The study has pointed out the need for additional research on early life stages of fishes in the eastern Gulf. The value of ichthyoplankton surveys in this region would be increased significantly if more kinds of eggs and larvae could be identified at the species level. Better ability to identify species would not only allow us to better delineate the egg or

larval distributions of important species but would help us to understand the reproductive biology of adults better and, in some cases, to determine the adult biomasses and fluctuations in biomass that occur from year to year. There should be an attempt in future analyses of ichthyoplankton survey data to determine assemblages of ecologically similar larval fishes in the Gulf region. This approach would help to define communities among the ichthyoplankton and would allow better prediction or interpretation of potential environmental effects on fish communities. The community analysis approach almost certainly would offer a better means to examine influences of major phenomena such as the Loop Current on reproduction and recruitment of fishes in the Gulf of Mexico.

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INTRODUCTION

Ichthyoplankton surveys were carried out on 17 cruises to the eastern Gulf of Mexico from 1971-1974. The extensive collections which resulted provided material upon which this report is based. A major objective of the report is to document the kinds and abundances of fish larvae that occur in the eastern Gulf and thus provide quantitative baseline information, not only on fish larvae, but also on the spawning areas used by some ecologically and economically important fishes. In addition, seasonality of occurrence and annual variations in larval abundances were considered. Larval abundances were compared among areas and by station depth. The diversity of larval fish assemblages was determined as were the relationships between larval occurrences and some physical-chemical factors. The Loop Current is an important feature of the eastern Gulf's physical oceanography (Maul, 1977) and its possible influence on distribution and transport of some larval fishes was examined. Larval mortality rates and adult biomass estimates (from the abundance of eggs or larvae) were obtained for selected species.

Ichthyoplankton collections upon which this report is based were obtained with financial support of a National Oceanic and Atmospheric Administration (NOAA) Sea Grant to the University of Miami. Objectives of that research were to determine adult biomasses and potential fishery yields of some clupeoid fishes from the eastern Gulf. Thus, only eggs or larvae in the families Clupeidae and Engraulidae were sorted from the samples and used in that research. Identification of all remaining taxa was undertaken as part of the present Bureau of Land Management (BLM) contract and analytical procedures were expanded to obtain a good understanding of factors that affect ichthyoplankton abundance and diversity.

The earliest cruises (1971-1972) were part of the interdisciplinary EGMEX and Western Florida Continental Shelf Program (Rinkel, 1974). Subsequent cruises were carried out by the University of Miami alone, but temperature and salinity data from those cruises and earlier cruises were analyzed and results were reported as part of a BLM MAFLA contract (SUSIO, 1975). Included in that SUSIO report (BLM Contract No. 08550-CT4-16) was a brief summary of the seasonal abundances and distributions of total zooplankton, fish eggs and larvae in the eastern Gulf (Houde, 1975). Houde and Chitty (1976) published results of that preliminary analysis (taxa were not identified) which indicated that there was a distinct seasonal character to variability in zooplankton biomasses and to total production of fish eggs and larvae.

Results of the Sea Grant-supported study on sardine-like fishes and their potential for exploitation also have been published (Houde, 1976). Detailed studies on three clupeid species provided estimates of their biomasses as well as the first information on their early life histories in the eastern Gulf of Mexico (Houde, 1977a, 1977b, 1977c).

Under the present BLM contract two Master's theses were completed by students who assisted on the project. Leak (1977) analyzed the data for larvae in the family Carangidae (jacks) and Dowd (1978) reported on larvae in the family Bothidae (left-eyed flatfish). Their objectives were similar to overall BLM project goals and data from their analyses are incorporated into this report. Because carangid and bothid larvae are among the most abundant in the eastern Gulf, the two theses were important information sources for this report.

Ichthyoplankton can provide a wealth of information about communities of fishes, particularly on early life stages, which are often the most environmentally sensitive and on the oceanographic conditions that are correlated with spawning activity by the fishes. We believe that information contained in this report will not only provide needed baseline information on larval kinds and abundances but also can be used to infer much about the ecology and life history of adult stages. Increasing use by man of continental shelf resources in the eastern Gulf, which includes exploration for hydrocarbons and significant fishing activity, possibly will alter the environment or impact stocks of demersal and pelagic fishes. Should such changes occur, results of our research will provide the means to judge how much the reproductive biology of the stocks has been affected and will help managers to develop sound strategies to manage eastern Gulf of Mexico resources.

METHODS

Cruises and Sampling Stations

There were 17 cruises, each of 7 to 19 days duration, in which 13 to 146 stations were sampled for ichthyoplankton (Table 1). The survey area extended from latitude $24^{\circ}45'$ N to latitude $30^{\circ}15'$ N (Figure 1). Designated sampling stations (except for Cruise GE7101) were on transects spaced at 28 km intervals and were parallel to lines of latitude. The GE7101 cruise, which was a preliminary sampling effort, was anomalous in many respects (for completeness, data from that cruise are included in the report). Stations were spaced at 28 km intervals, except offshore of the shelf break where the interval was increased to 56 km. Stations were located where water depths ranged from < 10 m to > 3000 m. Not all stations (Figure 1) were sampled on each cruise. Stations that were sampled on each cruise are given in Figure 2. Some stations, in addition to those illustrated in Figure 1, at depths < 10 m, were sampled on cruises CL7405 and CL7412 (Figure 2). Additional information about the cruises, ships and stations was given by Rinkel (1974) and, in particular, by Houde *et al.* (1976).

There were five cruises in 1971, 1972 and 1973 and two in 1974 (Table 1). A relatively stable pattern of sampling was established beginning with cruise IS7205. Prior to this cruise, the sampling effort depended to some extent on needs of other EGMEX investigators and on available ships. The sampling effort beginning with IS7205 was related only to the ichthyoplankton program. Houde *et al.* (1976) give additional details and the rationale for the sampling plan.

Sampling

A total of 869 stations was sampled on the 17 cruises. Station data that include station position, depth of tow, volume filtered, surface temperature, surface salinity, zooplankton volume and total numbers of fish eggs and larvae have been summarized and tabulated (Houde *et al.*, 1976). Collections were made with a 61-cm bongo net sampler (Posgay, Marak and Hennemuth, 1968), except for cruise GE7101 and TI7114 in which an ICITA, 1-m diameter, 505 μ m mesh plankton net was used. Catches were preserved in 10% seawater formalin and buffered with marble chips. After being brought to the laboratory, catches were transferred to a 5% formalin solution. Fish eggs and larvae were sorted from catches of the 505 μ m mesh net on the bongo sampler. Zooplankton volumes (cc per 1000 m³ of water strained) were determined from the bongo net's 333 μ m mesh net.

Oblique tows were made to within 5 m of bottom or to 200 m depth at deep stations. For cruises GE7101 through 8B7201 - GE7202 the tow consisted of wire release at 50 m min⁻¹ and wire retrieval at 20 m min⁻¹. On remaining cruises two types of tow were made, the choice depending on depth of the station. At stations < 55 m deep a 5 min tow was made, consisting of 1 min for wire release to desired

depth and 4 min₃ retrieval. This type of tow resulted in an average volume of 100 m³ being sampled. At stations > 55 m deep wire was released at 50 m min⁻¹ to desired depth and retrieved at 20 m min⁻¹. Volumes filtered in those tows varied from 100-400 m³, depending on the station depth. Houde (1977a) summarized the tow characteristic statistics for the two kinds of tow.

A flowmeter was placed in the mouth of the 505 µm mesh net to estimate the volume filtered. A time-depth recorder was attached to the sampler to record tow characteristics. Towing speed was 3.0-3.5 knots (1.5-1.8 m sec⁻¹) in 1971, but was reduced to an average speed of 2.3 knots (1.2 m sec⁻¹) in 1972-1974. Tows were made during both day and night; a station was sampled when the ship occupied it. Nets were towed from the side of all vessels except R/V CALANUS, from which tows were made at the vessel's stern (cruises CL7405 and CL7412).

The types of tows that were employed probably are adequate to obtain good quantitative estimates of ichthyoplankton abundance for most species. For some kinds of larvae, such as istiophorids and exocoetids, which inhabit the neuston and which are especially agile swimmers, the bongo net samples may underestimate true larval abundance. Even for these kinds of larvae, the bongo net sampler can produce a good estimate of relative abundance among stations, although the true abundance may not have been determined.

Temperatures and salinities were obtained at each station¹ from surface to 200 m depth. A mechanical bathythermograph (BT) provided a trace of the temperature structure at each station. The BT cast was followed by a hydrocast consisting of 1.7 l Niskin bottles equipped with reversing thermometers or by a salinity-temperature-depth (STD) cast (cruises IS7308 and IS7320 and some stations on IS7311 and IS7313). Rinkel used these data to produce charts of the distribution of temperature, salinity and sigma-t (Rinkel, 1974; SUSIO, 1975) at surface and at 10 m depth intervals. He also illustrated vertical profiles of these properties along selected sampling transects.

Laboratory Procedures

All fish eggs and larvae were sorted from 505 µm mesh net catches. Zooplankton volumes were determined from 333 µm bongo net catches (Houde and Chitty, 1976) using a displacement volume method like that described by Thrailkill (1969) and Kramer *et al.* (1972). Eggs and larvae of clupeid and engraulid fishes were identified, removed and used for Sea Grant-supported research. The remainder of the ichthyoplankton was counted and stored in 5% formalin. When BLM funding was available in 1977, these larvae were identified and form the basis of this report.

¹Data are on file at the National Oceanographic Data Center, Washington, D.C. and can be retrieved from the MAFLA file.

Identifications were made using the extensive descriptive literature collections of the Principal Investigators. Larvae of many fishes from the eastern Gulf of Mexico are undescribed, so that the identification task was difficult. Many larvae could be identified only to the family level. A relatively small number remained as "unidentified larvae." Except for clupeids, no fish eggs were identified. Some could have been identified, but the effort involved would not have been justified by the relatively few identifications that would have resulted. An initial effort was made to identify eggs, but it was abandoned when it was clear that little progress was being made.

Identifications of larvae were made with the aid of binocular microscopes. All larvae that were identified to species were measured to the nearest 0.5 mm standard length using an ocular micrometer.

Eel larvae (Anguilliformes) were identified by Dr. David G. Smith, University of Texas Biomedical Institute and most of the scombrid larvae were identified by Mr. Thomas Potthoff, National Marine Fisheries Service, Miami. Confirmation of our driftfish, Ariommidae, identifications was provided by Dr. John L. Butler, National Marine Fisheries Service, La Jolla.

Analytical Procedures

Descriptions of analytical procedures used for the clupeid and engraulid research have been published previously (Houde *et al.*, 1976; Houde, 1977a). Many of the techniques used for the present study were adapted from that earlier work and are not given in detail here. A brief summary of those methods is presented.

A computer program "ELSUM" was used to estimate the abundances of larvae that were identified at each taxonomic level for each station that was sampled on each cruise. An index of abundance at each station was the estimated number under 10 m² of sea surface. This index is

$$n_j = \frac{C_j Z_j}{v_j} \cdot 10$$

where n_j = the number of individuals (eggs or larvae) at station j under 10 m² of sea surface.

C_j = the catch of eggs or larvae at station j .

Z_j = the depth of tow (in metres) at station j .

v_j = the volume filtered by the net (in cubic metres) at station j .

Total abundance was the number estimated in the area represented by the station. Station total abundances were summed to give the estimated number of larvae in the area represented by the cruise. A cruise index of abundance was the estimated mean number of each taxon under 10 m² of sea surface for the entire cruise area. This index is

$$N_i = \frac{\sum_{j=1}^k n_j a_j}{A_i}$$

where N_i = the mean number of eggs or larvae of a taxon under 10 m^2 of sea surface for cruise i .

n_j = the number of eggs or larvae at station j under 10 m^2 of sea surface.

a_j = the area (in square metres) representing station j .

$A_i = \sum_{j=1}^k a_j$ = the summed station areas = the area representing cruise i (in square metres).

k = the number of stations in cruise i .

A length-frequency distribution (estimated abundances in each 0.5 mm length-class) at each station and for the entire cruise was printed out for all larvae that were identified to species.

Differences in both the index of abundance (number under 10 m^2 sea surface) and estimated total abundance were the criteria used to determine if seasonal or annual differences occurred for the most abundant taxa. Charts of the estimated distributions and abundances of important taxa were made to illustrate seasonal and annual shifts in numbers of larvae and areas of occurrence.

Differences in abundances of common species were compared between northern and southern sectors of the survey area and also between onshore and offshore zones. Latitude $27^{\circ}15'$ N was the line separating the northern from the southern half of the area, while the 50 m isobath was arbitrarily selected as the dividing line between onshore and offshore zones (Figure 1). Charted distributions of larval abundances and analysis of occurrence data were used as the criteria to delineate important spawning areas and to interpret seasonal or annual changes that were observed. Some interpretations were made at the family level in addition to those for common species.

Biomasses of adults were estimated from the abundances of eggs or earliest stage larvae. If an estimate of eggs or youngest larvae produced annually can be made, and if the fecundity or adult females and sex ratio of adults is known, then biomasses can be estimated from the relationship: $B = P_a F_r^{-1} K^{-1}$, where

B = biomass of adults (grams)

P_a = number of eggs (or youngest larvae) produced annually

F_r = relative fecundity (ova per gram)

K = proportion of adults that is female.

The use of this technique and modifications of it to obtain biomass estimates for eastern Gulf fishes has been discussed by Houde (1977a) for clupeids and by Leak (1977) for carangids. We were able to estimate biomasses for only a few fishes because eggs usually could not be identified and because fecundity estimates were not available for most species.

Measures of diversity were used to examine relationships among kinds and abundances of larvae. Estimates of diversity were used to determine how numbers of species and their abundances in the ichthyoplankton community varied seasonally, annually and between the north-south and onshore-offshore sectors of the survey area. In 1973, when all five cruises sampled the same transects and, with few exceptions, the same stations, diversity was measured at each station. Diversity at stations located on transects off Tampa Bay and Sanibel Island was determined for all cruises where those transects were sampled.

Diversity was estimated using the information theory measure H' (Pielou, 1974; Poole, 1974) and Simpson's measure of diversity C (Simpson, 1949; Poole, 1974; May, 1975). In addition, species richness R (Margalef, 1968) was estimated for 1973 cruises. A taxocene (the group of organisms under study) of 94 species of larvae for which 10 or more individuals had been collected during the 17 cruises was designated and used in all diversity calculations.

Shannon-Weaver diversity was estimated from the equation,

$$H' = - \sum_{i=1}^s p_i \log_e p_i$$

where s is the number of species in a collection and p_i is the proportion of individuals in the i th species. Our values for p_i in the diversity estimates were based on the ratio of the estimated abundances of each species in the collections relative to the total estimated abundance of the s species in the collection. The maximum value of H' is $H'_{\max} = \log_e s$. The Shannon-Weaver estimator is biased, especially for collections that sample a relatively small part of the habitat, which is the case in ichthyoplankton surveys. Hutcheson (1970) proposed use of the following series to obtain the expected value of H' .

$$H' = - \sum_{i=1}^s p_i \log_e p_i - \frac{s-1}{2N} + \dots$$

The first two terms in this series usually are sufficient to correct for sampling bias (Poole, 1974) and we used the above expression to estimate H' . The value of N in the above expression is the total number of individuals of the s species in the collection. Estimates of

the variances of H' were made for cruise, north-south and onshore-offshore diversity measures using the equation given by Hutcheson (1970)

$$\text{Var } (H') = \frac{\sum_{i=1}^s p_i (\log_e p_i)^2 - \left(\sum_{i=1}^s p_i \log_e p_i \right)^2}{N} + \frac{s-1}{2N^2} + \dots$$

The evenness of distribution of individuals among s species was estimated from

$$J = H' / H'_{\max}$$

If individuals of each of the s species in a collection are equally abundant the value of J is 1.0. Lower values of J indicate the degree to which a community may be dominated by some species that are relatively abundant in collections.

Simpson's index of diversity was estimated according to the equation

$$C = \sum_{i=1}^s \frac{n_i (n_i - 1)}{N (N - 1)}$$

where n_i is the number of individuals representing the i th species and N is the total number of individuals in the s species. The index estimates the probability of randomly drawing two individuals of the same species in sequence. Thus, a value of C near 1.0 indicates that the community is dominated by one or a few species.

Species richness was estimated only for the November, 1972 and all 1973 cruises. The index was calculated for the cruise, for onshore-offshore zones and for north-south sectors for the six cruises where sampling effort was nearly identical. The estimator is

$$R = s - 1 / \log_e N$$

where s is the number of species represented and N is the number of individuals in the s species.

Apparent mortality was measured by the decrease in estimated abundances of larvae in successive length classes. For selected species annual estimates of the rate of decline in abundance were made or, for species that were less common, a mean rate of decline for pooled 1971-1973 data was estimated. Rates of decline were estimated

from the exponential regressions of estimated abundances of larvae in either 0.5 mm or 1.0 mm length-classes on lengths (Houde, 1977a). These estimates are termed "apparent mortality" because they do not account for increased avoidance capabilities of larvae as they grow, nor do they account for possible changes in growth rates of larvae during development.

Simple linear correlations of \log_{10} abundance of selected fish larvae species with water depth, surface temperature, surface salinity and plankton volume were made. Correlations were carried out only for samples where larvae occurred, because zero occurrences often were from areas where the particular species of larva never occurred. Abundances, expressed as numbers under 10 m² of sea surface, were transformed to \log_{10} abundances before the correlations were run to help homogenize variances.

Possible effects of Loop Current transport or entrainment of offshore species of fish larvae onto the shelf were examined by relating occurrences of larvae to the presence of ≥ 36.5 ‰ salinity water. Intrusions of such high salinity water represent Loop Current penetration onto the shelf or eddies that have broken away from the Loop and moved across the shelf. Rinkel (SUSIO, 1975) charted the occurrences of such water in the eastern Gulf for the 17 cruises contributing to our study. Transparent overlays of these charts for cruises 8C7113-TI7114, 8C7120-TI7121, 8B7201-GE7202, IS7209 and all 1973 cruises were made which were compared to charted distributions of the larvae of interest. The numbers of positive station occurrences were noted for the species within the ≥ 36.5 ‰ water and at lower salinities in each of three depth zones (< 50 m, 50-100 m, > 100 m). Resulting data were pooled from all cruises and tabulated. Occurrences were tested for independence with respect to salinity and depth in a contingency chi-square analysis. Significant chi-squares were examined to determine if the large components of chi-square resulted from occurrences of a species at shallow stations with ≥ 36.5 ‰ salinity. Such conditions were judged to indicate a Loop Current entrainment effect.

Computer Programs and Disposition of Data

Station parameter and larval catch data for each cruise have been stored on a program file at the University of Miami computer facility. These data will be transferred to the National Oceanographic Data Center (NODC). Hydrographic data from the 17 cruises have already been processed and are stored at NODC in the MAFLA file. Biological data from the earlier Sea Grant-supported clupeid and engraulid ichthyoplankton research were sent to NODC previously and can be retrieved through Accession Number 761430.

A computer program "ELSUM" was used to list taxa and numbers of observations, calculate estimated abundances and indices of abundance, and print out length-frequency distributions for taxa identified at the species level.

Other programs were written to interface the ELSUM data with standard statistical programs. Using the summarized ELSUM output, diversity and mortality estimates were made in the laboratory on desktop calculators.

Much of the individual station data has not been summarized on a station by station basis for this report. These data include frequencies of occurrence and lengths of larvae that were collected at each station. Detailed analyses of the abundances and size structures of larval populations within the survey area could be undertaken by retrieving these data at some future time.

Storage of Samples

Most eggs and larvae are being stored in 5% formalin at the University of Miami. Syngnathidae (pipefishes) were sent to Mr. C.E. Dawson, Gulf Coast Research Laboratory, Ocean Springs, Mississippi. Elopidae (tarpon, ladyfish) were sent to Dr. David Smith, University of Texas Biomedical Institute, Galveston, Texas. Larvae of the groupers (Epinephelinae) were sent to Dr. David Johnson, Marine Resources Research Institute, Charleston, South Carolina. Larvae of Ophichthidae (snake eels) and Lutjanidae (snappers) probably will be sent within the next few months to investigators who have requested this material.

RESULTS

Kinds and Abundances of Ichthyoplankton

A total of 143,034 larvae and 304,620 eggs was collected at 869 stations in 17 cruises to the eastern Gulf of Mexico between 1971 and 1974 (Table 1). Ninety-one families of larval fishes were identified (Table 2). These families included 130,541 individuals, or 91.3% of all larvae that were collected. Larvae not identified at the family level usually were mutilated too badly to be identified, but in some cases the larvae were not known. The 10 most frequently observed families, in ranked order, are presented in Table 3 for each of the 17 cruises. The 20 most frequently observed families, summed over all cruises, are listed in Table 4. In the identified families, we recognized 161 genera and 173 species (Tables 5-21). Tables 5-21 contain the numbers of observations, estimated total abundances in the cruise area, and mean number under 10 m² of sea surface for each taxon that was recognized in the 17 cruises. These tables contain the most basic data in the report. For three of the 10 most numerous families, no individuals were identified at the generic or specific level (Table 4).

Most of the larvae were in a relatively few families (Tables 2-4). The 20 most frequently observed families included 82.8% of all larvae that were collected and the 10 most numerous families included 66.6% of all larvae. Families that predominated on individual cruises (Table 3) usually were the same ones that had the highest ranked abundances for all cruises combined, but some differences were observed that reflect seasonality of spawning and also, in some cases, differences in stations that were sampled.

A total of 59,701 larvae were identified to species (Tables 5-21) which is 41.7% of all larvae collected. Ninety of the 173 identified species were in the 20 most common families. Those 90 species included 56,992 individuals which represented 39.8% of all larvae collected and 95.5% of all larvae that were identified to species. Success in identifying larvae varied among families. More than 50% of the larvae in 6 of the 20 most common families were identified to species (Table 4).

Larvae of Clupeidae (sardines and herrings) were most common in eastern Gulf collections, comprising 29,290 individuals, 20.5% of all larvae collected (Tables 2-4). The Gobiidae (gobies) were second in frequency of occurrence, with 21,621 individuals, 15.1% of all larvae. Clupeid larvae usually were identified to species. Gobiids were not identified below the family level. Larvae of Bothidae (left-eyed flounders) were third most common (6.4%) followed by Myctophidae (lanternfishes) (5.1%) and Serranidae (seabasses) (4.9%). The five most common families included more than 50% of all larvae that were collected. In those five families, 44,517 larvae were identified to species, 74.6% of all species identifications.

Other families among the 20 most common (Table 4) which had many individuals identified to species, were Carangidae (jacks) (3.9%), Bregmacerotidae (codlets) (2.6%), Gonostomatidae (lightfishes) (1.7%) and Sparidae (porgies) (1.2%). Some families such as the Scombridae (tunas and mackerels) (0.9%) were not among the 20 most common families (Table 2) but they were common and many individuals were identified to species. Families that occurred most frequently and which also had many species identifications, were selected to describe temporal and areal variability in larval abundances in the eastern Gulf. In this way we gained an understanding of spawning patterns, seasonal trends in ichthyoplankton abundance and diversity, and relationships between larval occurrences and the eastern Gulf environment.

A descriptive account follows on the occurrences and abundances of families for which larvae were collected. Some information also is provided about important species that were identified in each of the families. The account is based on information tabulated for this report, especially in Tables 2-4, 5-21, 22-38, and 39. Some of these species are considered again in later parts of the report that deal with specific aspects of their distribution or biology.

1. Elopidae (6 larvae; 2 genera; 2 species)

Five small larvae of the tarpon Megalops atlantica were collected on two cruises in June-July (GE7117, IS7311) at stations where water depth was > 50 m. A single larva of the ladyfish Elops saurus was collected at a station < 50 m deep in November (IS7209).

2. Clupeidae (29,290 larvae; 5 genera; 4 species)

Larval sardines and herrings were the most common larvae in our collections. Clupeid larvae were included in the 10 most frequently observed families on 15 of the 17 cruises and were the most common family on eight cruises. Most occurred in shelf waters over depths < 30 m, but larvae of Etrumeus teres and sometimes Sardinella anchovia occurred farther offshore. Houde (1977a, 1977b, 1977c) and Houde et al. (1976) have reported on these larvae in earlier publications. The following account gives new information and summarized the published data.

Brevoortia spp. (92 larvae)

Larvae of Brevoortia (menhaden), possibly two species, B. smithi and B. patronus, were collected on four fall and winter cruises and two occurrences were observed on spring cruises. They occurred at < 30 m depths and were less common than any of the other clupeids, suggesting that menhaden populations are relatively small in the eastern Gulf.

Etrumeus teres (1,089 larvae)

Round herring larvae were common on 10 fall, winter and spring cruises, with peak abundances in winter (Figure 3). Larvae of E. teres were among the 20 most frequently observed, identified species on eight

of the 17 cruises and also were among the 20 most abundant species (no. under 10 m^2) on eight of the cruises, when mean abundances ranged from 1.7 to 21.5 under 10 m^2 . Most occurrences (75%) were between the 30 and 100 m isobaths (Figures 4 and 5). They are most abundant off Tampa Bay and north of the Tortugas. Houde (1977a) gave a detailed account of round herring larvae and adult biomass in the eastern Gulf.

Harengula jaguana (3,846 larvae)

Scaled sardine larvae were common along the entire coastline at depths $< 30\text{ m}$ in spring and summer (Figures 6-8), and occurred rarely in fall and winter cruises in the southernmost part of the survey area. They were collected on 12 of the cruises. Larvae of H. jaguana were among the 20 most frequently observed, identified species on eight of the 17 cruises and were among the 20 most abundant (no. under 10 m^2) families on six cruises, when mean abundances ranged from 0.4 to 14.4 under 10 m^2 . They were more abundant in 1973-1974 cruises than in 1971-1972 (Figure 6). Houde (1977c) gave details of scaled sardine larvae and adult biomass in the eastern Gulf.

Opisthonema oglinum (11,315 larvae)

Thread herring were the second most common clupeid larva. Spawning occurs mostly during spring and summer and most larvae (80%) were collected at stations $< 30\text{ m}$ deep (Figures 9-11). Larvae of O. oglinum were collected on 11 cruises and were included in the 20 most frequently observed species on each of those cruises. They were the most frequently observed species on six cruises. Thread herring larvae were among the 20 most abundant species on nine cruises, when mean abundances ranged from 0.3 to 172.8 under 10 m^2 . The abundance of larvae indicates a large adult biomass in the eastern Gulf. Larvae in the eastern Gulf and adult biomasses were discussed by Houde (1977b).

Sardinella anchovia (12,311 larvae)

Spanish sardine was the most common clupeid larva. This species was collected on 15 cruises. A possibly anomalous catch of 4,098 larvae was made on cruise CL7412 (Table 21), which may have inflated numbers of observations and estimated abundances. Annual mean abundances apparently fluctuated greatly during the period 1971-1974. Larvae of S. anchovia were more abundant in 1972 than in other years (Figure 12). Larvae occurred in all months, but late summer apparently is the peak spawning season. In winter, occurrences were noted only in the southern one-fourth of the survey area. Most occurrences (92%) of S. anchovia larvae were at stations $< 50\text{ m}$ deep, but these larvae frequently were collected at stations between the 50 and 200 m isobaths (Figures 13 and 14). Spanish sardine larvae occurred over a wider range of depths in the eastern Gulf than did other clupeid larvae. This indicates that the apparently large adult population also is more widely distributed than populations of other clupeid species in the eastern Gulf.

3. Engraulidae (2,880 larvae)

Anchovy larvae were the twelfth most common family, but none were identified to species. Several species may be present. Occurrences were most frequent in waters < 50 m deep but some larvae were collected offshore. Larvae occurred on all 17 cruises and at all seasons, but were most abundant in spring and summer when 88.2% of the larvae were collected. Most engraulid larvae (62.5%) were collected in the northern half of the survey area, implying that adult populations are more abundant in that sector. The relative abundance of engraulid larvae is much less than that of clupeid larvae in shelf waters of the eastern Gulf indicating that adult biomasses of engraulids also may be significantly smaller than those of clupeids.

4. Argentinidae (45 larvae; 3 genera)

Argentine larvae were collected on 10 cruises. Specimens of Argentina spp. (31 larvae), Nansenia spp. (4 larvae) and Microstoma spp. (1 larva) were collected. All, except two larvae of Nansenia, occurred at stations > 50 m deep. Argentinids occurred at all seasons. Argentine larvae are uncommon in the eastern Gulf but occurrences are not rare in offshore waters.

5. Bathylagidae (11 larvae; 1 genus)

Deepsea smelts, collected on seven cruises, were represented by Bathylagus spp. All specimens were collected at stations where depth was > 50 m and some were collected in all seasons. Larvae are uncommon in the deep shelf and slope waters of the eastern Gulf.

6. Gonostomatidae (2,486 larvae; 11 genera; 12 species)

Lightfishes were the fourteenth most common family observed in the collections. They were collected on 15 cruises and were present on all cruises that sampled stations at depths > 50 m. Occasionally, some larvae were collected at stations < 50 m deep. Gonostomatids were among the 10 most frequently observed families on 5 of the 17 cruises. Four genera were most common: Cyclothone - 425 larvae; Gonostoma - 169 larvae; Maurollicus - 1,102 larvae; Vinciguerrria - 350 larvae. Maurollicus muelleri is one of the most commonly observed and abundant fish larvae in samples from offshore waters of the eastern Gulf.

Cyclothone spp. (425 larvae)

Larvae of Cyclothone were not identified to species. They were collected on 15 cruises and occurred at offshore stations in all seasons (Figure 15).² Mean abundances for the entire cruise area ranged from 1-9 under 10 m² for cruises where they occurred, except for CL7412 in which only three offshore stations were sampled and in which a single Cyclothone spp. larva was collected.

Gonostoma elongatum (161 larvae) and G. atlanticum (4 larvae)

Larvae of G. elongatum were collected on 12 cruises and were common in all seasons at offshore stations (Figures 16 and 17), occurring only rarely at stations < 100 m deep. They were the third most commonly observed gonostomatid larva in the collections. A second species, G. atlanticum (4 larvae) was collected on two summer cruises (IS7205, IS7313). It apparently is far less common than G. elongatum in the eastern Gulf.

Maurollicus muelleri (1,102 larvae)

This is the most abundant gonostomatid larva in our collections. It was observed on 14 of the 17 cruises. Its estimated abundance in 1973 was much higher than in other years (Figure 18) but it was common in all years. Maurollicus muelleri usually occurred at stations > 100 m deep (85% of all occurrences) but occasionally was observed at shallower depths. There was evidence that this species may be most common in summer, but specimens were collected at all seasons (Figures 19 and 20). Larvae of M. muelleri were among the 20 most frequently observed species on 10 cruises and were among the 20 most abundant species on 11 cruises. On those 11 cruises mean abundances ranged from 1.0 to 54.7 larvae under 10 m² for the entire cruise area. On cruise IS7313, M. muelleri was the most abundant larva identified to the species level.

Vinciguerrria spp. (350 larvae)

Three species were identified. Vinciguerrria nimbaria (166 larvae) was most common; V. poweriae (127 larvae) was next in abundance; and V. attenuata (51 larvae) was observed the fewest times. All three species usually occurred at stations where water depths were 50 m or deeper (Figures 21-24). There is evidence of seasonality in the occurrence of V. nimbaria; larvae were more abundant in spring-summer when 78.3% were collected, than at other seasons (Figure 25). Distributions and abundances were not plotted by cruises for the two less common species, but tabulated abundances and the plotted seasonal mean abundance of V. poweriae (Figure 26) give no hint of any strong seasonal differences. For cruises where they occurred, mean abundances under 10m² ranged from 0.1-3.6 for V. nimbaria, 0.1-2.1 for V. poweriae and 0.1-0.9 for V. attenuata. Though common in offshore waters of the eastern Gulf, Vinciguerrria spp. larvae were rarely among the 20 most frequently observed species on cruises. This contrasts with Ahlstrom's (1971) data from the eastern tropical Pacific, where Vinciguerrria spp. were the second most abundant kind of larva in his collections.

Other gonostomatids (22 larvae)

Seven additional genera (six species identified) were collected. Polymetme (?) Type I (15 larvae) was collected on five cruises, always at stations > 50 m deep. Other gonostomatids were Margrethia obtusirostre (1 larva), Ichthyococcus ovatus (2 larvae), Pollichthys

mauli (1 larva), Diplophos spp. (1 larva), Valenciennellus tripunctulatus (1 larva) and Bonapartia pedaliota (1 larva).

7. Sternoptychidae (166 larvae; 3 genera)

Sternoptychids were collected on 10 cruises. Three genera of sternoptychids were recognized but larvae could not be identified to species. Argyropelecus spp. (70 larvae) and Sternoptyx spp. (75 larvae) were most common. Excepting a large catch of Sternoptyx spp. on cruise 8C7120-TI7121 individuals of Argyropelecus spp. were usually about twice as abundant as Sternoptyx spp. The third kind of larva, Polyipnus spp. (3 larvae) occurred only on a single cruise (TI7131-8B7132). There was no indication of seasonality in occurrence or abundance of hatchetfish larvae in the eastern Gulf. A few larvae occurred on most cruises where stations > 50 m deep were sampled. Argyropelecus spp. was observed on 10 cruises and Sternoptyx spp. was observed on eight cruises. All sternoptychids, except one larva, were collected at stations > 50 m deep.

8. Stomiatidae (16 larvae; 1 genus; 1 species)

A single specimen of Stomias affinis was identified. The remaining 15 larvae were Stomias spp. Larvae were collected at all seasons and occurred on nine cruises. All occurrences were at stations > 50 m deep.

9. Chauliodontidae (24 larvae; 1 genus)

All specimens were Chauliodus spp. Larvae occurred on nine cruises; there was no apparent seasonality in their occurrence. Twenty-two of the 24 larvae were collected at > 50 m stations; the two exceptions were collected on cruise GE7101 in the southernmost part of the survey area where the isobaths converge rapidly bringing oceanic waters in close proximity to the shelf.

10. Astronesthidae (1 larva)

A single larva was collected on cruise GE7208 at an offshore station. It was not identified to species.

11. Melanostomiatidae (30 larvae)

Melanostomiatid larvae occurred on nine of the cruises. None were identified to genus or species. Some larvae were collected at all seasons, but 23 of the 30 specimens were taken in fall and winter suggesting that these larvae may be more abundant in those seasons. All larvae occurred at stations > 50 m deep.

12. Synodontidae (4,294 larvae; 2 genera; 2 species)

Lizardfish larvae were the seventh most frequently observed family. Larval synodontids occurred on all 17 cruises. Only 10 specimens, which were transforming or metamorphosed, were identified

to species. A directed effort to solve systematic problems on small larvae in this family could result in many larvae being identified. Larvae were collected throughout the survey region and at all seasons although they were most frequently collected in spring-summer (74.5% of the larvae). Larvae occurred with the same frequency in northern and southern sectors of the survey area. Most larvae (67.0%) occurred at stations > 50 m deep. Eight specimens were identified as Saurida brasiliensis and two as Synodus foetens. Other species almost certainly are present in the collections. Larvae of synodontids were abundant at all seasons, with mean abundances exceeding 10 larvae under 10 m² of sea surface on 12 of the 17 cruises.

13. Aulopidae (5 larvae; 1 genus; 1 species)

Five larvae of Aulopus nanus were collected. A single specimen was taken on each of five cruises; all were collected at stations > 50 m deep.

14. Scopelarchidae (28 larvae)

Scopelarchids were collected on nine cruises; they occurred in all seasons. No attempt was made to identify them to species. All except one larva were taken at stations > 50 m deep.

15. Evermannellidae (6 larvae; 1 genus; 1 species)

A single specimen, Coccorella atrata, was identified to species. The six specimens of evermannellids were collected on five cruises at stations > 50 m deep. No seasonality was apparent.

16. Paralepididae (292 larvae)

Larvae of paralepidids were collected frequently at offshore stations, occurring on 13 of the 17 cruises. They were not identified to species. Paralepidids occurred at all seasons, but 229 of the 292 larvae that were collected were taken in spring-summer. Larvae of paralepidids were collected in near equal numbers at stations in the northern and southern sectors of the survey area. Except for one larva, all were found at stations > 50 m deep.

17. Myctophidae (7,223 larvae; 16 genera; 25 species)

The Myctophidae is a speciose family whose larvae are relatively well known. They were collected on all 15 of the cruises where stations > 50 m deep were sampled. Lanternfishes were the fourth most frequently observed family, even though relatively few offshore stations were sampled compared to stations at < 50 m depth. Myctophid larvae dominated the catches from stations at depths > 100 m. All except 245 myctophid larvae were identified to genus or species. The genus Diaphus was most common in our collections, but identification of its larvae to species was seldom possible. Other common myctophids were Notolychnus valdiviae, Myctophum nitidulum, M. selenops, Ceratoscopelus warmingi, Hygophum reinhardti, Benthosema suborbitale

and Diogenichthys atlanticus. These seven species included 1,709 larvae, 23.7% of the myctophids that were collected.

Diaphus spp. (3,646 larvae)

Larvae of Diaphus spp. comprised 50.5% of all myctophids that were collected. They were common during all seasons and it was not unusual to collect small numbers at stations shallower than 50 m (Figures 27 and 28). Several species of Diaphus occur in the eastern Gulf and larvae could not be identified to species. A few transforming or metamorphosed specimens were identified. The most common was D. dumerili (7 specimens); other species, represented by single individuals, are D. lucidus, D. taaningi and D. bertelseni.

Notolychnus valdiviae (267 larvae)

Larvae of N. valdiviae occurred on 12 cruises and were found throughout the eastern Gulf at stations > 100 m deep (Figure 29). A few occurrences (20%) were recorded at 50-100 m depths. Abundances usually were higher in spring-summer than in fall-winter (Figure 30) and distribution of larvae was more confined to the southern half of the survey area in winter months (Figure 31). This species was among the 20 most abundant species on eight cruises, when its mean abundance ranged from 1.2-9.5 larvae under 10 m of sea surface. Larvae of N. valdiviae transform at a smaller size than any other myctophid. Many of our specimens were transforming larvae or juveniles.

Lampadena luminosa (42 larvae)

This species was collected on nine cruises and occurred mostly during spring-summer (37 larvae). Other species of Lampadena have been reported from the Gulf of Mexico, only larvae of L. luminosa, the most abundant species, have been described and we assumed our specimens to be that species. It was never observed frequently but its overall distribution reflects widespread occurrence in eastern Gulf waters > 50 m (Figure 32).

Lampanyctus spp. (124 larvae)

Seventy-eight larvae were identified to species. Lampanyctus alatus (54 larvae) was most frequently observed. It occurred widely over the outer shelf and at deeper stations (Figure 33) in 10 spring, summer and fall cruises, but was absent from winter collections. Larvae of L. cuprarius (16 larvae) were less common, occurring on only five cruises, but had a similar distribution (Figure 34) and seasonal occurrence to L. alatus. A third species, L. ater, occurred on four cruises and was represented by only eight larvae. One of those larvae was taken on a winter cruise (IS7303). Many Lampanyctus (46 larvae) could not be identified to species. Twenty-six of these occurred during winter cruises.

Myctophum spp. (704 larvae)

Four species of Myctophum were recognized. Larvae of M. nitidulum (613 larvae), which occurred on 13 cruises, were observed most frequently. It was among the 20 most abundant larvae on 11 cruises, when its mean abundance ranged from 0.8–18.0 larvae under 10 m². Myctophum nitidulum also was one of the 20 most frequently observed species on 10 cruises. It occurred at all seasons but was clearly most abundant during spring-summer (Figure 35). Its distribution was widespread in the eastern Gulf. Although most occurrences (70%) were at stations > 100 m deep, it often occurred at relatively shallow stations near the 50 m isobath (Figures 36 and 37). Despite reduced abundances in fall and winter, its distribution remained widespread throughout the year. Larvae of M. selenops (84 larvae), which occurred on 11 cruises, were the second most common Myctophum larva (Figure 38). They also occurred most frequently on spring-summer cruises. Except for a single occurrence, all M. selenops larvae were collected at stations > 50 m deep. Interestingly, they were absent from the area north of latitude 28°30'N and west of 86°W on the August 1971 cruise (8C7120–TI71210), where M. nitidulum larvae were abundant (Figure 37). That area was sampled only on that cruise and no conclusions about comparative distributions can be made, but it suggests that M. selenops and M. nitidulum may have different patterns of occurrence in the northeastern Gulf. Two additional species, M. obtusirostris (2 larvae) and M. asperum (1 larva) occurred in the collections.

Ceratoscopelus warmingi (151 larvae)

Ceratoscopelus warmingi is a common myctophid larva in the eastern Gulf that occurred on 14 of the 17 cruises. It is widely distributed (Figure 39) and occurred during all seasons. It was collected occasionally (four instances) at stations < 50 m deep and was not uncommon (23.6% of occurrences) at 50–100 m depth stations. Larvae of C. warmingi were among the 20 most abundant species on six cruises when mean abundances ranged from 0.8–5.0 larvae under 10 m².

Hygophum spp. (1,090 larvae)

Larvae of Hygophum spp. were among the most commonly collected myctophids but only a few were identified to species. Hygophum reinhardtii (66 larvae) was collected on 12 cruises; it occurred in all seasons at station > 50 m deep (Figure 40). Two specimens of H. benoiti also were identified from two summer cruises (8C7120–TI7121 and IS7313).

Centrobranchus nigroocellatus (38 larvae)

Larvae were collected on 10 cruises. They occurred in all seasons. Most C. nigroocellatus larvae were collected at stations > 100 m deep (87% of occurrences) (Figure 41). Although not frequently observed, some larvae of this species can be expected to be taken on most cruises that include offshore stations in the eastern Gulf.

Notoscopelus spp. (56 larvae)

Two species of Notoscopelus were identified. Notoscopelus resplendens (13 larvae), though less frequent in occurrence than N. caudispinosus (43 larvae), was collected on 7 cruises while N. caudispinosus was taken only during two winter cruises (GE7101 and IS7303). The observed distribution of N. caudispinosus occurrences (Figure 42) indicates a widespread area of occurrence in the eastern Gulf including stations < 50 m deep. Notoscopelus resplendens larvae also are distributed widely (Figure 43) and perhaps are more consistently present in the eastern Gulf than are N. caudispinosus larvae.

Lobianchia gemellari (21 larvae)

A few larvae of L. gemellari were collected on 7 cruises. They did not occur on winter cruises and few were observed on November cruises, indicating that spring-summer spawning occurs in the eastern Gulf. They were widely distributed in the eastern Gulf with most occurrences (75%) at stations > 200 m deep (Figure 44).

Benthosema suborbitale (345 larvae)

Benthosema suborbitale larvae were collected on 13 cruises and are abundant in the eastern Gulf. They were among the 20 most abundant species on seven cruises when mean abundances ranged from 0.8–29.6 larvae under 10 m². They are widely distributed at stations where depths are > 100 m and occasionally occur (17% of occurrences) at stations in the 50–100 m depth zone (Figures 45 and 46). There was no evidence of seasonality in their occurrence, but exceptionally large catches of B. suborbitale larvae on the May cruise, GE7208, give the impression of very great abundance in spring-summer of 1972 (Figure 47). Except for that cruise, B. suborbitale mean abundances ranged from < 1 to 5 under 10 m² for all cruises where offshore stations were sampled.

Diogenichthys atlanticus (183 larvae)

The distribution of this common myctophid larva in the eastern Gulf is much like that of Benthosema suborbitale (Figures 48 and 49). Larvae of D. atlanticus occurred on 10 cruises. There is no evidence of seasonality in its occurrence, although it seems to have been less abundant in 1971 than in 1972–1973 (Figure 50). Larvae of D. atlanticus were among the 20 most abundant species on seven cruises when mean abundances ranged from 0.9–6.4 larvae under 10 m². Larvae sometimes occurred over relatively shallow depths at stations in the 50–100 m depth zone (12% of occurrences).

Other myctophids (187 larvae)

Lepidophanes spp. (169 larvae) accounted for most of these larvae. A single transformed specimen from cruise 8C7113–TI7114 was identified as L. guntheri, but the remaining 168 larvae could not be

identified to species. Larvae of Lepidophanes occurred at all seasons. Bolinichthys spp. (5 larvae) was observed from two cruises and Gonichthys coccoi (4 larvae) occurred on three cruises. Larvae of Symbolophorus rufinus (9 larvae) were collected at four stations on a single cruise (GE7208).

18. Ipnopidae (1 larva)

A single ipnoid larva was collected on cruise GE7101. No attempt was made to identify it to species.

19. Chlorophthalmidae (11 larvae; 1 genus; 1 species)

Eleven larvae of Chlorophthalmus agassizi were collected on six of the cruises. There was no apparent seasonality in their occurrences. The larvae were collected at stations > 50 m deep (Figure 51).

20. Notosudidae (2 larvae; 1 genus; 1 species)

Two larvae were collected. One was identified as Scopelosaurus mauili; the other was Scopelosaurus spp. The identified larva was collected in summer (8C7120-TI7121); the other specimen was collected in winter (GE 7101). The unidentified specimen was taken at a station where water depth was < 50 m, but the station is in the southernmost part of the survey area and deep water was nearby.

21. Giganturidae (1 larva; 1 genus; 1 species)

A single Gigantura vorax larva was collected at an offshore station on cruise IS7311.

22. Muraenidae (130 larvae; 2 genera; 2 species)

Seventy-eight leptocephalus larvae were identified to species. Most were Gymnothorax nigromarginatus (74 larvae) but Anarchias yoshiae (4 larvae) also was present. Larvae of G. nigromarginatus occurred on 10 cruises and those of A. yoshiae occurred on three cruises. Moray leptocephali were most frequently collected in spring, summer and fall cruises. Few were observed in winter. Leptocephali of G. nigromarginatus were widely distributed (Figure 52). They frequently occurred at stations > 50 m deep (58% of all occurrences) but also were well represented at < 50 m deep stations. All four specimens of A. yoshiae were collected at stations > 50 m deep.

23. Nettastomidae (90 larvae; 1 genus; 3 species)

Forty-one nettastomid leptocephali were identified to species. All identified specimens are in the genus Hoplunnis. Hoplunnis diomedianus (32 larvae) was observed most frequently; H. macrurus (6 larvae) and H. tenuis (3 larvae) were less common. Leptocephali of H. diomedianus were collected on 10 cruises; there was no apparent seasonality of occurrence. The two other species each were collected

on three cruises, with no apparent seasonality. Seventy-nine of the nettastomid larvae (87.8%) were taken at stations > 50 m deep and 11 were taken at shallower stations. All H. macrurus and H. tenuis occurred at offshore stations. Most H. diomedianus also occurred offshore (93% of occurrences) (Figure 53).

24. Congridae (146 larvae; 7 genera; 5 species)

Conger eel leptocephali were common in eastern Gulf ichthyoplankton collections. Only 26 of the 146 specimens were not identified to either genus or species. Congrid leptocephali occur in offshore waters of the eastern Gulf and there is no apparent seasonality in their occurrence.

Ariosoma balearicum (16 larvae)

Leptocephali of A. balearicum occurred on seven cruises. All specimens were collected at stations > 50 m deep (Figure 54).

Uroconger syringinus (3 larvae)

Three leptocephali were collected on cruise IS7320. Leptocephali occurred at two stations where water depth was > 200 m.

Paraconger caudilimbatus (23 larvae)

This species was collected on only two summer cruises. Twenty-two of the 23 leptocephali were from cruise 8C7120-TI7121 and a single specimen was from IS7313. Except for one occurrence, all individuals were taken at stations where depth was > 200 m (Figure 55).

Hildebrandia spp. (60 larvae)

Two species of Hildebrandia were recognized. Leptocephali of H. gracilior (45 larvae) were most common and occurred in catches from 12 of the 17 cruises. Distribution of H. gracilior leptocephali is restricted to offshore waters, with most occurrences (87%) at stations > 100 m deep (Figure 56). A second species, H. flava (12 larvae) was collected on four cruises; it is less common but it also was restricted to the offshore zone (Figure 57).

Other congrids (18 larvae)

Twelve leptocephali of a congrid assigned to Nistactichthys spp. were collected on three cruises. Four specimens of Gnathophis spp. were found on three cruises and two leptocephali of Xenomystax spp. were taken on cruise GE7208.

25. Ophichthidae (208 larvae; 3 genera; 2 species)

Leptocephali of snake eels were the most frequently observed kind of eel larva. Relatively few could be identified beyond the family level. Ophichthids were widely distributed over the shelf and slope areas in the eastern Gulf.

Myrophis punctatus (16 larvae) occurred on six fall and winter cruises. No leptocephali of this species were found in spring-summer. It has a wide distribution between the 15 m isobath and shelf break at > 200 m depth (Figure 58). Two specimens of Ahlia egmontis were collected on cruise GE7208, one at a station < 50 m deep and the second at a station > 50 m deep. Sixty larvae were identified as Ophichthus spp. They occurred during all seasons.

26. Dysommidae (2 larvae)

A single larva was collected on each of two summer cruises (8C7120-TI7121 and IS7313). Both occurrences were at stations where water depth was > 50 m.

27. Belonidae (6 larvae)

Six larval needlefishes were collected at stations < 50 m deep. They were not identified to species. Occurrences were on five cruises during spring, summer and fall.

28. Hemiramphidae (45 larvae; 3 genera; 4 species)

Larvae of Hyporhamphus unifasciatus (33 larvae), which occurred on nine cruises, were the most frequently collected hemiramphid. Some larvae were taken in all seasons, although most occurred during spring-summer. Except for a single occurrence, all H. unifasciatus larvae were collected at stations < 30 m deep (Figure 59). Hemiramphus brasiliensis (3 larvae) and H. balao (8 larvae) were less frequently observed. Larvae of H. brasiliensis occurred on three spring-summer cruises and those of H. balao on four cruises which indicated that some spawning by this species occurs in all seasons. A single specimen, tentatively identified as Oxyporhamphus micropterus, was collected at a station in summer (8C7120-TI7121) near the Tortugas where water depth was < 50 m. Catches of hemiramphid larvae probably do not reflect the true abundance of halfbeaks in the eastern Gulf. These larvae, which hatch out at large size and are strong, agile swimmers, almost certainly avoid the sampling gear in most instances.

29. Exocoetidae (72 larvae; 4 genera; 3 species)

Flying fish larvae were collected mostly in spring and summer. Prognichthys gibbifrons (28 larvae) was most common. Except for one winter occurrence, which was in the southern half of the survey area, P. gibbifrons occurred on nine spring and summer cruises. The distribution of P. gibbifrons is widespread (Figure 60), but most occurrences (75%) are offshore of the 50 m isobath. Parexocoetus brachypterus (21 larvae) was collected during seven summer and fall cruises. With one exception, it was collected where depths are < 50 m (Figure 61). A single larva of Danichthys rondeleti was collected near the Tortugas in winter (GE7101). Nine larval Cypselurus spp. were taken during spring and summer. Exocoetid larvae, like the hemiramphids, are agile swimmers and most larvae probably avoid the sampling gear, causing their abundances to be underestimated.

30. Gadidae (54 larvae; 1 genus)

All gadid larvae and small juveniles were Urophycis spp., possibly regius and floridanus. These larvae occurred only on five winter and fall cruises. Urophycis larvae were widely distributed between the 10 and 200 m depth contours. Thirty larvae were taken where depths were < 50 m and 24 were taken at deeper stations.

31. Bregmacerotidae (3,818 larvae; 1 genus; 4 species)

The codlets were the ninth most frequently occurring family. Four species of Bregmaceros larvae were present. Two of these apparently are undescribed species that we have called Type A and Type B. They are the most abundant bregmacerotid larvae in the eastern Gulf. The other species are B. atlanticus and B. macclellandi. Bregmacerotids were present in most ichthyoplankton samples from the outer shelf and offshore waters during all cruises.

Bregmaceros Type B (2,554 larvae)

This species occurred on 15 cruises and is the most often collected codlet larva in our samples. It occurs at stations in the shallowest water and has the widest range of the four species found in the eastern Gulf. Type B larvae often were collected at stations < 50 m deep (36% of all Type B occurrences) and 84% of its occurrences were at stations whose depths were < 100 m (Figures 62 and 63). Some Type B larvae did occur far offshore. A seasonal pattern of occurrence is not well developed but larvae were more abundant during fall than at other seasons (Figure 64). Bregmaceros Type B was among the 20 most abundant larvae on 13 cruises, when its abundance ranged from 3.7–42.3 larvae under 10 m². It was the most frequently observed, identified larva on three cruises and among the 20 most frequently observed larvae on 14 of the 17 cruises.

Two larvae of Bregmaceros Type B, 4.0 mm SL and 13.5 mm SL, are illustrated (Figure 65). Although undescribed in the literature it is distinctive. The larvae have relatively little pigment. The occipital ray does not develop until larvae are approximately 6.5 mm SL.

Bregmaceros Type A (962 larvae)

This is the second most frequently collected codlet larva. It occurred on 14 cruises. Few occurrences of this species (5%) were recorded from stations < 50 m deep (Figures 66 and 67). Estimated mean abundance was very high in 1972 but the larvae were not abundant in 1973 (Figure 68), indicating that spawning intensity of Bregmaceros Type A varies annually in the eastern Gulf. Bregmaceros Type A was one of the 20 most abundant larvae on 12 cruises; for those cruises its abundance ranged from 0.9–35.1 under 10 m². It was one of the 20 most frequently observed, identified species on 10 cruises.

Two larvae of Bregmaceros Type A, 3.0 mm SL and 12.5 mm SL, were illustrated (Figure 69). These larvae also are distinctive. They are

moderately pigmented, with numerous melanophores over the brain, at the base of the pectoral fins and in the developing pelvic fins. The occipital ray develops at approximately 3.0 mm SL. Several prominent melanophores are present on the filament.

Bregmaceros atlanticus (247 larvae)

Bregmaceros atlanticus is a darkly pigmented codlet larva that usually is collected farther offshore than B. Type A or B. Type B, although the distributions of all three species overlap. Larvae of B. atlanticus occurred on 13 cruises. Bregmaceros atlanticus occurred only once at a station where depth was < 50 m (Figures 70 and 71) and 76% of its occurrences were at stations > 100 m deep. There was no apparent seasonality in its occurrence. Although less abundant than Type A or Type B, B. atlanticus was among the 20 most abundant species that were collected on 9 of the 17 cruises.

Bregmaceros macclellandi (33 larvae)

This species is relatively uncommon in the eastern Gulf but it was collected on nine cruises. Its distribution and that of B. atlanticus are similar, but on average B. macclellandi occurred even farther offshore (Figures 72 and 71). A single occurrence of B. macclellandi larvae was recorded at a station < 100 m deep. There were no apparent seasonal trends in its abundance.

32. Macrouridae (4 larvae)

One specimen was collected on each of four cruises. The four specimens occurred at stations > 50 m deep.

33. Fistulariidae (1 larva; 1 genus)

One cornetfish larva, Fistularia spp., was collected at a station where depth was < 50 m on cruise CL7412.

34. Macrorhamphosidae (3 larvae; 1 genus; 1 species)

Three larvae of Macrorhamphosus scolopax occurred in two winter cruises (GE7101 and IS7303). Station depths were > 50 m.

35. Syngnathidae (247 larvae; 2 genera; 7 species)

Some syngnathids were collected on every cruise except GE7117. Many of the specimens apparently were associated with masses of floating seaweed that were occasionally collected by the sampler. One species of seahorse, Hippocampus erectus, and six species of pipefishes, Syngnathus spp., were identified.

Hippocampus erectus (40 specimens)

Individuals were collected on 14 cruises. Thirty of the 40 specimens were taken during fall and winter, indicating that most

reproduction occurs in those seasons. Occurrences were recorded from all parts of the survey area < 100 m deep, but most occurrences (82%) were at stations where depth is < 50 m (Figure 73).

Syngnathus dunckeri (2 specimens)

Single individuals were collected on two of the cruises (GE7101 and TI7131—8B7132). One was collected at a station < 50 m and the second at a station > 50 m deep.

Syngnathus elucens (52 specimens)

Individuals occurred on 14 cruises. They were most common in spring and summer (36 of 52 specimens) but some occurred in fall and winter. Syngnathus elucens occurred throughout the north-south extent of the survey area, mostly at stations < 50 m deep, (86% of occurrences), but occasionally out to depths of 100 m (Figure 74).

Syngnathus pelagicus (2 specimens)

Two specimens were collected, one in winter (8B7201—GE7202) and one in late summer (IS7205). Both occurred at stations > 50 m deep.

Syngnathus springeri (55 specimens)

This species occurred on 12 cruises. Forty-five of 55 specimens (81.8%) were collected in fall and winter. Except for two instances, larvae occurred inshore of the 50 m isobath and most occurrences were in the northern half of the survey area (Figure 75).

Syngnathus louisianae (15 specimens)

This species was collected on five cruises. There was no evidence of seasonality in its occurrences. It occurred throughout the north-south extent of the survey area, but it apparently is confined to shallow waters of the eastern Gulf (Figure 76). Only a single occurrence was at a station > 10 m deep.

Syngnathus scovelli (64 specimens)

This pipefish occurred on 11 cruises. It was collected in all seasons. Distribution of S. scovelli is the most confined of any species of Syngnathus that we observed in the eastern Gulf. Specimens were collected only in the northeast sector of the survey area and never at stations where depth exceeded 20 m (Figure 77).

36. Melamphaeidae (38 larvae; 1 genus)

Larvae of Melamphaes spp. were collected on ten cruises. There was no evidence of seasonality in their occurrence. All occurrences were at stations > 50 m deep. None could be identified to species.

37. Holocentridae (34 larvae; 1 genus; 1 species)

A single specimen of Adioryx vexillarius was identified from cruise TI7131-8B7132. Remaining squirrelfish larvae were not identified to species. They occurred at all seasons; 27 of the 34 larvae, including the identified A. vexillarius, were taken at stations > 50 m deep.

38. Caproidae (42 larvae; 1 genus; 1 species)

Two specimens of Antigonia capros were identified, one from 8C7120-TI7121 and one from TI7131-8B7132. Both occurred at stations > 50 m deep. Other larvae were Antigonia spp. (40 larvae). Most larvae occurred in fall and winter and the majority (36 out of 40) came from stations > 50 m deep.

39. Mugilidae (252 larvae; 1 genus)

Larvae of mullets were collected on 14 of the cruises. All mullet larvae were classified as Mugil spp. It was suspected that larvae collected in fall and winter were Mugil cephalus and that most larvae from other months were M. curema. But, the descriptions of small mullet larvae were not definitive enough for us to confidently assign individuals to species. Most of the larvae (75.4%) were collected in the southern half of the survey area and most larvae (62.3%) were collected at stations < 50 m deep. For the 165 larvae collected in fall-winter, 90 were caught at stations > 50 m deep. For the 87 larvae caught in spring-summer, only 4 were caught at stations > 50 m deep. The differences in seasonal onshore-offshore distributions may reflect differences in spawning areas of the two major species, M. cephalus and M. curema, in the eastern Gulf.

40. Atherinidae (45 larvae; 2 genera; 2 species)

Membras martinicus (41 larvae) were collected on two cruises (GE7210 and CL7412). They were taken at three stations adjacent to the coast (< 10 m depth). There were two occurrences of Menidia beryllina (2 larvae), one on cruise IS7320 and another on CL7405. Both specimens were taken at stations < 10 m deep.

41. Sphyraenidae (34 larvae; 1 genus; 3 species)

Three species of barracudas were collected. Sphyraena borealis (15 larvae) occurred from late winter until early summer and was taken on six cruises. In contrast, Sphyraena barracuda (16 larvae) occurred only during spring and summer; it was collected on four cruises. The distributions of the two species differed (Figure 78). With a single exception, all occurrences of S. barracuda were at stations > 50 m deep; most S. borealis occurrences were at stations < 50 m deep and no larvae occurred at > 100 m depths. A single larva of S. guachancho was collected on cruise GE7208. It occurred at a station > 50 m deep.

42. Serranidae (6,949 larvae; 12 genera; 16 species)

The serranids are a speciose family whose larvae are represented in the eastern Gulf by four major subfamilies. The anthiines are stout-bodied larvae with heavy spination on the head and opercular areas; serranine larvae are "typical" perciform larvae with moderate spination on the head and opercular areas; epinephelines have a characteristic melanophore on the tail, moderate spination on head and opercular areas, and greatly elongated spines in the developing first dorsal and pelvic fins; grammistine larvae usually are nearly without melanophores, the short, developing first dorsal fin often has the anteriormost rays extended into flagellae or filaments, and the head and opercular areas are without spination. The serranine types were by far the most frequently collected serranid larvae and one species, Diplectrum formosum, dominated the serranid material. Some kinds of serranid larvae were collected at all stations in the survey area. Unlike other speciose families (e.g. Myctophidae), which were found only offshore, serranids are represented by some species which spawn in virtually every part of the eastern Gulf of Mexico.

AnthiinaeHemanthias vivanus (395 larvae)

Larvae of H. vivanus occurred on 14 cruises from stations near the 50 m isobath to stations at > 200 m depth (Figures 79 and 80). Larvae were collected infrequently in summer and were most abundant in winter and spring (74.2% of larvae) (Figure 81). Hemanthias vivanus larvae were among the 20 most abundant species that were identified on seven cruises, when their abundance ranged from 0.9 to 8.4 larvae under 10m² and they were included among the most frequently observed species on eight cruises. A single specimen of H. leptus was collected in winter (GE7101).

Pronotogrammus aureorubens (78 larvae)

This species occurred at stations where depth was > 50 m on nine of the cruises (Figure 82). Most larvae (85.9%) were collected during winter and spring. It occurred more frequently in the southern half of the survey area than in the northern half (Figure 82).

Anthias spp. (106 larvae)

Three species (types) of Anthias were collected. Like other anthiines they occurred most frequently in fall through spring and, excepting one species, were less common in summer. These larvae were recognized based on recent descriptions by Kendall (unpublished manuscript). Anthias Type I (60 larvae) occurred on 10 cruises and was most often collected. Fifty-six of 60 larvae occurred on winter-spring cruises. Larvae were collected at stations from near the 100 m isobath to those at > 200 m depth (Figure 83). Only three larvae of Anthias Type II were observed. They occurred at three offshore stations on two of the summer cruises (GE7117 and 8C7120-TI7121). Anthias Type III (29

larvae) were collected on winter-spring cruises at stations where depth was > 100 m (Figure 84). Their distribution and seasons of occurrence were similar to those of Anthias Type I.

Plectranthias garupellus (2 larvae)

Two specimens of P. garupellus were collected on cruise IS7320 at two stations > 50 m deep.

Serraninae

Diplectrum formosum (3,963 larvae)

This is one of the most frequently observed and abundant larvae in the eastern Gulf. All Diplectrum larvae were identified as D. formosum based on the distributions of Diplectrum species adults given by Bortone (1977). Larvae of D. formosum occurred on all 17 cruises. Most larvae occurred from spring to fall, but some were collected in winter, indicating that some spawning takes place in all months. Abundances were greatest in spring and summer (Figure 85). Larvae were widely distributed over the shelf; one-half of the occurrences were at stations < 30 m deep and 90% of occurrences were at station < 60 m deep (Figures 86 and 87). Diplectrum formosum larvae were among the 20 most abundant species that were identified on 15 of the cruises, when their mean abundances ranged from 0.8 to 29.8 larvae under 10 m² of sea surface. They were among the 20 most observed species of all 17 of the cruises.

Centropristis striata (196 larvae)

Black sea bass larvae occurred from fall to spring and were observed on seven cruises. Most larvae were collected in the northeast corner of the survey area at stations < 30 m deep (Figures 88 and 89). Some larvae that were referred to C. striata, especially those that occurred at stations > 50 m deep, might be other species of Centropristis, since C. ocyura and C. philadelphica have been reported from the eastern Gulf.

Serraniculus pumilio (390 larvae)

Larvae of pygmy sea bass were common and were collected on 13 cruises. They occurred from spring to fall but were most abundant in spring-summer (Figure 90). Larvae apparently were more abundant in 1972 than in other years. They were taken at stations throughout the north-south extent of the survey area (Figures 91 and 92). Except for four occurrences, all larvae were collected at stations < 50 m deep; 50% of occurrences were at stations < 25 m deep. Larvae of S. pumilio were among the 20 most abundant identified species on three cruises and were included in the 20 most frequently observed species on six of the cruises.

Serranus spp. (207 larvae)

Larvae of Serranus were common but could not be identified to species. They occurred in 12 of the cruises. Some Serranus occurred in all seasons.

EpinephelinaeEpinephelus type larvae (146 larvae)

Five advanced larvae were identified as Epinephelus morio. No other grouper larvae could be identified to species. The five E. morio larvae occurred on two spring cruises (8C7113-TI7114 and IS7308) at stations where depths ranged between 50 and 200 m. Most epinepheline larvae were collected in the southern half of the survey area (Figure 93). Larvae occurred between the 10 m and 200 m isobaths, except for one occurrence at a station > 200 m deep.

GrammistinaeRypticus spp. (181 larvae)

Most larvae of Rypticus were most identified to species. Occurrences were most common in spring and summer when 98% of the Rypticus larvae were collected. Larvae occurred from near the coast out to the 200 m isobath (Figure 94). Six specimens were identified as R. saponaceus. Five of the six larvae were taken in two summer cruises; the remaining larvae was collected in November. All except one R. saponaceus were collected at stations > 50 m deep. A single R. maculatus larva was collected at a station > 50 m deep on cruise 8C7120-TI7121.

Liopropoma spp. (24 larvae)

Scattered occurrences of Liopropoma spp. larvae were observed in seven spring and summer cruises. Most larvae occurred at stations > 50 m deep. Six large specimens, collected on cruises 8C7113-TI7114 and 8C7120-TI7121, resembled the Type I (5 larvae) and Type II (1 larva) Liopropoma discussed by Kendall (unpublished manuscript) and they were given those designations.

43. Priacanthidae (154 larvae; 2 genera; 3 species)

Most priacanthids could not be identified to species. Pseudopriacanthus altus (11 larvae) was recognized and three specimens of Priacanthus arenatus (2 larvae) and P. cruentatus (1 larva) were identified. Larval priacanthids occurred mostly in spring-summer (132 out of 154 specimens) and most larvae (68.8%) were collected at stations > 50 m deep. More priacanthid larvae were collected in the southern half of the survey area (67.5%) than were collected in the northern half.

44. Apogonidae (2,296 larvae)

Larval cardinalfishes were the fifteenth most frequently observed family. They were collected on all 17 cruises. None were identified to species, although some specimens probably could have been identified if time had permitted. Occurrences and abundances of apogonids were highest in spring and summer but some larvae were collected on all cruises. Most larvae (75%) were collected at stations < 50 m deep. They occurred with near equal frequency in the northern and southern sectors of the survey area.

45. Branchiostegidae (26 larvae; 1 genus; 1 species)

Larval tilefishes occurred on 10 cruises. There was no apparent seasonality in their occurrence or abundance and all except one larva were collected at stations > 50 m deep. Most of the larvae were Caulolatilus spp. (16 larvae) and two were identified as C. cyanops.

46. Echeneidae (3 larvae)

Three remora larvae were collected on two spring-summer cruises (8C7120-TI7121 and GE7208) at stations > 50 m deep. They were not identified to species.

47. Rachycentridae (2 larvae; 1 genus; 1 species)

Two cobia larvae were collected on cruise 8C7120-TI7121. One occurred at a station > 50 m deep and the second at < 50 m depth.

48. Carangidae (5,564 larvae; 10 genera; 8 species)

Carangids were the sixth most frequently occurring family of larvae in our eastern Gulf collections. A more detailed account of their abundance and distribution, based on the same cruises, was given by Leak (1977). Some species of carangids were present in every part of the eastern Gulf. Characteristic depth distributions were noted for some species and seasonality of occurrence was apparent. One species, Decapterus punctatus, dominated the carangid catches and also was one of the most abundant of all fish larvae in the eastern Gulf.

Decapterus punctatus (4,431 larvae)

Round scad were the most frequently occurring carangid larvae. They were collected on 16 cruises, at all seasons, but their abundance was highest during spring and summer (Figure 95). Abundance of D. punctatus larvae apparently was higher in 1972 than in 1971 or 1973. They were among the 20 most abundant identified species on 16 cruises, when mean abundances ranged from 1.9 to 55.3 larvae under 10 m². They also were among the 20 most frequently observed species on the 16 cruises in which they occurred. Larvae occurred throughout the survey area from spring to fall, but in winter their distribution was restricted to the southern half of the survey area (Figures 96 and 97). Most larvae were collected (68% of occurrences) at stations where depth

was < 50 m. Leak (1977) discussed spawning by D. punctatus, including an estimate of adult biomass, in the eastern Gulf.

Trachurus lathami (185 larvae)

Rough scad T. lathami were less common than the round scad. Rough scad larvae were collected on seven cruises during fall, winter and spring. This species apparently does not spawn in summer in the eastern Gulf. Trachurus lathami were included in the 20 most abundant species on three cruises; mean abundances on those cruises ranged from 2.8 to 4.3 larvae under 10 m². They also were among the 20 most frequently observed species in these winter cruises. Distribution of T. lathami larvae was mostly restricted to stations where depth exceeded 50 m, but there were some occurrences at shallower stations (Figure 98). More than 70% of occurrences were between the 50 and 200 m isobaths. The larvae occurred along the entire north-south extent of the survey area.

Chloroscombrus chrysurus (774 larvae)

Atlantic bumper larvae were common, but were collected only during eight spring and summer cruises, indicating that spawning by this species is confined to the warmest months of the year. On six of those cruises they were among the 20 most frequently observed species that had been identified and on four cruises they were among the 20 most abundant species in the survey area (mean abundance ranging from 0.2 to 3.1 larvae under 10 m²). All C. chrysurus larvae occurred nearshore, at stations < 50 m deep (Figure 99). Ninety-five percent of all occurrences were at stations where depth was < 35 m.

Caranx spp. (89 larvae)

Only bluerunners C. crysos (12 larvae) were identified to species. Larvae of Caranx occurred mostly during spring-summer (83 of 89 larvae). All of the identified C. crysos were collected on a single cruise (8C7120-TI7121) and all except one larva occurred at stations > 50 m depth. All occurrences of C. crysos except one were in the southern half of the survey area, but because larvae were only collected on a single cruise this does not necessarily indicate that spawning is most prevalent there. Unidentified Caranx larvae also occurred offshore. Only six occurrences of Caranx spp. were recorded at stations < 50 m deep while 38 occurrences were observed at stations > 50 m deep.

Oligoplites saurus (14 larvae)

Larvae of the leatherjacket were collected on four spring-summer cruises. All occurrences were at stations < 20 m deep (Figure 100).

Selene vomer (15 larvae)

Larvae of the lookdown occurred on three cruises during summer. Thirteen of these larvae were collected on a single cruise (8C7120-TI7121). Lookdown larvae occur offshore; all occurrences were at stations > 50 m deep (Figure 101).

Seriola spp. (38 larvae)

Larvae of the amberjacks, which were collected on 11 cruises, were not identified to species. Some larvae were collected in all seasons. Most occurrences were at stations > 50 m deep.

Other carangids (11 larvae)

Two specimens of Vomer setapinnis were collected at offshore stations, one in each of two summer cruises. Six Elagatis bipinnulata occurred at a single offshore station on cruise GE7208. Three larvae of Trachinotus spp. were collected during three spring and summer cruises.

49. Bramidae (30 larvae)

Bramid larvae were collected on six cruises in fall, winter and spring. They were not identified to species. Eighteen of the 30 larvae were collected at stations < 50 m deep.

50. Coryphaenidae (17 larvae; 1 genus; 2 species)

Dolphin larvae were not common in our eastern Gulf collections. Occurrences were observed in all seasons, but 16 of the 17 larvae were collected in spring, summer or fall cruises. Coryphaena hippurus (7 larvae) were more frequently observed than C. equiselis (2 larvae); small larvae could not be identified to species and were designated Coryphaena spp. (8 larvae). Fourteen of the 17 larvae that were collected occurred at stations > 50 m deep.

51. Lutjanidae (1,753 larvae; 4 genera; 3 species)

Lutjanids were the nineteenth most abundant family of fish larvae; few could be identified to species. Most of the unidentified snapper larvae probably are in the genera Lutjanus and Rhomboplites. Larger larvae of these two genera can be identified based on meristics but small larvae cannot be distinguished. Some relatively large larvae of Rhomboplites aurorubens were recognized. Several species of Lutjanus occur in the eastern Gulf. Only three larvae could be definitely identified as Lutjanus spp. Larval lutjanids were collected on 16 cruises in all seasons, but they were most abundant in summer when 79% of all lutjanid larvae were collected. Some kinds of lutjanid larvae occurred at all depths in the survey area but most occurrences were between the 30 and 100 m isobaths. Most (76.9%) of the lutjanid larvae were collected in the southern half of the survey area.

Rhomboplites aurorubens (34 larvae)

Larvae of vermilion snapper were collected on 10 cruises during all seasons. Thirty-two of the larvae (94%) were taken in summer and fall. Most spawning apparently occurs in summer. Larvae occurred over a wide area of the eastern Gulf within the 200 m isobath. Most occurrences were at stations between 30 and 100 m depths in the southern half of the survey area (Figure 102).

Pristipomoides aquilonaris (41 larvae)

Larvae of wenchman occurred at all seasons but most were collected in spring and summer. They occurred farther offshore than most other lutjanid larvae. Most larvae were taken between the 50 and 200 m isobaths (Figure 103). A single larva was collected at a station < 50 m deep.

Symphysanodon typus (6 larvae)

The strange larvae of Symphysanodon typus, which may not be a true lutjanid, were collected on five cruises. Four of the six larvae were collected in fall; the remaining two individuals came from a spring and a winter cruise. Larvae of S. typus occurred at stations > 50 m deep.

52. Acanthuridae (17 larvae; 1 genus)

Larvae of Acanthurus spp. (17 larvae) were taken on 9 cruises. There was no apparent seasonality in their occurrence. Fourteen of the 17 larvae were collected at stations > 50 m deep.

53. Gerreidae (1,458 larvae)

Gerreid larvae were collected on each of the 17 cruises, but most (92.7%) larvae were taken in spring and summer. None could be identified to species. Ninety-four percent of all gerreid larvae were collected at stations < 50 m deep and 80.2% of the larvae were collected in the southern half of the survey area.

54. Pomadasyidae (2,933 larvae; 1 genus; 1 species)

Pomadasyid larvae were the eleventh most common family represented in our collections. A single species, Orthopristis chrysoptera, was identified. Most of the unidentified pomadasyids probably were Haemulon spp. Pomadasyid larvae, other than O. chrysoptera, occurred on all 17 cruises but their abundance was highest on late winter and spring cruises (78.4% of the larvae). Most (96.3%) of the unidentified pomadasyids were collected at stations where water depth was < 50 m.

Orthopristis chrysoptera (771 larvae)

Pigfish larvae were common in catches of eight winter and spring cruises. They were among the 20 most frequently observed and

identified species on five cruises and were among the 20 most abundant species on three cruises, when their mean numbers under 10 m² ranged from 1.0 to 6.1. Seasonal peaks in abundance clearly show the well defined spawning season (Figure 104). Pigfish spawn in coastal waters; they were more abundant in the northern half of the survey area than in the southern half (Figures 105 and 106). No O. chrysoptera larvae were collected at stations where depth exceeded 31 m and 75% of the larval occurrences were at stations < 20 m deep. The biggest observed catch was on cruise CL7405 when several nearshore stations (< 10 m) were sampled in addition to the usual stations in the survey, indicating that most pigfish spawning may occur closer to the coast than the area represented by our usual survey stations.

55. Sciaenidae (415 larvae; 6 genera; 9 species)

The Sciaenidae were well represented in our samples but they were less abundant than they might have been if the survey area had included more coastal or estuarine stations. Most sciaenids spawn within a few km of the coast. Our larval catches show the coastal distributions of larvae and roughly delineate spawning area in the eastern Gulf.

Cynoscion spp. (89 larvae)

Three species of seatrout (weakfish) larvae were collected. The most common was C. nebulosus (67 larvae). Spotted seatrout larvae were collected on nine cruises and occurred in all seasons. Sixty of the 67 larvae were collected on spring cruises, indicating that spawning is most intense in that season. Most larvae occurred at stations < 10 m deep and all larvae were collected within the 15 m isobath (Figure 107). Cynoscion arenarius (21 larvae) were taken on three cruises in winter, spring and summer. The five station occurrences for this species were all within the 20 m isobath (Figure 108). A single larva of C. nothus was collected on a fall cruise (TI7131-8B7132) at a station of 25 m depth.

Leiostomus xanthurus (192 larvae)

Spot larvae were the most frequently observed sciaenid in our catches. They occurred on 10 of the cruises in fall, winter, and spring. Most of the larvae (64.1%) were collected on spring cruises, indicating peak spawning in that season. Spot larvae were the most widely distributed sciaenid (Figure 109). More than 50% of the larval occurrences were at stations < 15 m deep, but offshore occurrences were not uncommon and one occurrence was observed offshore of the 50 m isobath. Spot larvae were more abundant in the northern half of the survey area than in the southern half (Figure 109).

Menticirrhus spp. (52 larvae)

Two species of Menticirrhus were identified. Larvae of M. saxatilis (27 larvae) were observed on four cruises in winter, spring and summer. All larvae were collected at stations < 20 m deep and all occurrences except one were in the central third of the survey area

(Figure 110). A total of four larvae of M. americanus were collected on a spring (IS7308) and a fall (TI7131-8B7132) cruise. They occurred at stations < 20 m deep. Several Menticirrhus spp. (21 larvae) could not be identified to species.

Micropogon undulatus (16 larvae)

Croaker larvae were collected on five cruises but they were not abundant. They occurred in fall, winter and spring, but 13 of the 16 larvae were taken in November cruises. Larvae were distributed along the entire north-south extent of the survey area and all occurrences were at stations < 30 m deep (Figure 111).

Other sciaenids (5 larvae)

Two larvae of Pogonias cromis were collected nearshore in March (CL7405). Three larvae of Bairdiella chrysura were collected in the last week of June (IS7311) at two stations < 10 m deep. A relatively large number of sciaenid larvae (61) were not identified. Some of these larvae may be small specimens of Stellifer lanceolatus and Sciaenops ocellata.

56. Sparidae (1,683 larvae; 4 genera; 4 species)

Larvae of sparids were the twentieth most frequently observed family. Most larvae occurred during winter and spring cruises; occurrences were uncommon in summer. The most commonly identified sparid was Lagodon rhomboides. Archosargus probatocephalus larvae also were common in the collections. Most sparid larvae could not be identified to species; many probably are Calamus spp. More than 90% of the unidentified sparid larvae were collected at stations < 50 m deep.

Diplodus holbrooki (111 larvae)

Larvae of spottail pinfish were observed on only two cruises during winter (IS7303 and CL7405). The four stations at which they were sampled were in the northeast corner of the survey area and were < 15 m deep (Figure 112).

Lagodon rhomboides (338 larvae)

Pinfish larvae occurred on seven cruises in fall, winter and spring. Most larvae were collected in winter (97.6%). Larval pinfish occurred throughout the north-south extent of the survey area. They were among the 20 most frequently observed, identified species on four cruises and were included in the 20 most abundant species on three cruises, when their mean abundances ranged from 1.3 to 11.7 under 10 m². More than 60% of the station occurrences were at depths < 30 m but the larvae were relatively widely distributed, with some catches occurring beyond the 50 m isobath (Figure 113). Some small, unidentified sparid larvae may have been L. rhomboides because we could not identify the smallest larvae with certainty and chose not to assign them specific names.

Pagrus pagrus (7 larvae)

Larvae of the red porgy were uncommon in our eastern Gulf collections. They were collected on three cruises, all in winter. For the four observed station occurrences, two were at < 50 m depth and two were at > 50 m.

Archosargus probatocephalus (322 larvae)

Sheepshead larvae occurred in catches from five cruises in winter and spring. Catches were restricted to nearshore stations; all larvae were collected at stations < 20 m deep (Figure 114). Larvae were more frequently collected and were most abundant in the northern half of the survey area.

57. Mullidae (302 larvae; 1 genus; 1 species)

Larvae of goatfishes were collected on 12 cruises. Most could not be identified to species. Some larvae occurred in all seasons but they were most common in winter and spring (94.4% of larvae). Most mullid larvae (60.9%) were taken at stations where depth was < 50 m, but offshore occurrences were relatively common. A single species, Mullus auratus (11 larvae), was recognized from large specimens collected on three spring cruises.

58. Kyphosidae (18 larvae; 1 genus)

A few larvae of Kyphosus spp. were collected on seven cruises. Except for a single summer occurrence (1 larva), larvae occurred in fall, winter and spring. Ten of the 18 larvae were collected at stations < 50 m deep.

59. Ephippidae (1 larva; 1 genus; 1 species)

A single larva of Chaetodipterus faber was collected in November on cruise IS7320 at a station > 50 m depth.

60. Chaetodontidae (32 larvae)

At least two kinds of chaetodontid larvae were collected. None were identified to species. They occurred on 12 cruises in all seasons. There was no well-developed seasonal pattern in occurrences of chaetodontid larvae, although more were collected in spring-summer than at other seasons. Most chaetodontids (75%) occurred at stations > 50 m deep.

61. Pomacentridae (445 larvae)

Damselfish larvae occurred on 15 of the 17 cruises. None were identified to species, although several larvae were tentatively identified as Abudefduf saxatilis. Eggs of fishes in this family are demersal, but larvae are pelagic. Larvae occurred in all seasons but numbers of occurrences were less frequent in winter than at other

seasons. Most occurrences (69.0%) were at stations < 50 m deep. Larval occurrences were observed throughout the north-south extent of the survey area.

62. Labridae (3,230 larvae)

The wrasses were the tenth most frequently sampled larvae in our collections. Several kinds were present but they could not be identified to species. Many individuals were believed to be Thalassoma spp. and Hemipteronotus spp. Some labrids were collected on each of the 17 cruises but 85% occurred during spring and summer. Larvae were collected over the entire shelf area in the eastern Gulf but were somewhat more common (59.0% of larvae) at stations < 50 m deep. Labrid larvae occurred more frequently and were more abundant in the northern half of the survey area (69.5% of larvae) than in the southern half.

63. Scaridae (569 larvae)

Larvae of parrotfishes were common but we were unable to identify them to species. They occurred on 16 of the 17 cruises, with most occurrences in summer and fall when 70.8% of the larvae were taken. Parrotfish larvae were distributed widely in the eastern Gulf, but most occurrences were at stations > 50 m. deep (61.0% of the larvae). More larvae were collected in the southern half of the survey area (67.0%) than in the northern half.

64. Opistognathidae (417 larvae)

At least two kinds of jawfish larvae were collected but not identified to species. They occurred on 15 cruises in all seasons but the majority of larvae were collected in spring (78.4% of the larvae). More larvae (63.3%) were taken in the southern half of the survey area than in the northern half. Some jawfish larvae were collected at stations where depth was > 50 m but 89.4% of the larvae were collected at stations < 50 m deep.

65. Uranoscopidae (1 larva; 1 genus; 1 species)

A single larva of the stargazer Astroscopus y-graecum was collected on cruise TI7131-8B7132 at a station < 50 m deep.

66. Blenniidae (1,996 larvae)

Blenny larvae were the eighteenth most common family. No attempt was made to identify them to species. They occurred on all 17 cruises and were most frequently collected in winter-spring when 85.5% of them were taken. The blenniids were more common in the northern half of the survey area, where 78.8% of the larvae were collected. They have a nearshore distribution; 95.8% of the blenny larvae were collected at stations < 50 m deep.

67. Clinidae (502 larvae)

Clinid larvae were collected on all 17 cruises. None were identified to species. There was no apparent seasonality in their occurrences. Larvae were collected throughout the north-south extent of the survey area. Of larvae collected, 78.9% occurred at stations < 50 m deep.

68. Ophidiidae (4,151 larvae)

Cusk-eel and brotulid larvae were the eighth most frequently observed family. Several kinds of these larvae were collected but no attempt to identify them to species was made. Ophidiids occurred on all 17 cruises but were more frequently observed in spring-summer than at other seasons. They occurred throughout the survey area. Although most of the larvae were collected at stations < 50 m deep (75.1%), the estimated mean abundances (no. under 10 m²) were highest offshore on several of the cruises.

69. Carapidae (305 larvae; 2 genera; 2 species)

Two species of carapids were collected. The more common of the two species has been designated Echiodon sp. It was identified based on recent literature describing carapid larvae (Olney and Markle, in press). The larvae are believed to belong to a single species, which, as adults, has been commonly observed in trawl catches from the eastern Gulf (Robert Shipp, personal communication)¹, but which has not been described. The other species, whose larvae were relatively uncommon, is Carapus bermudensis.

Carapus bermudensis (13 larvae)

Larvae occurred in catches from six cruises in spring, summer and fall. Most occurrences were in the southern half of the survey area and occurrences were nearly equal at < 50 m and > 50 m deep stations (Figure 115).

Echiodon sp. (289 larvae)

This species was collected on 15 of the 17 cruises. Larvae occurred in all seasons but 79.2% of them were obtained in summer and fall. The distributions of Echiodon sp. and Carapus bermudensis overlapped but Echiodon occurred over a broader area (Figure 116). Most larval occurrences (> 90%) of Echiodon sp. were at stations > 50 m deep.

¹Dr. Robert Shipp, University of Alabama, Dauphin Island Laboratory.

70. Callionymidae (1,605 larvae)

Dragonet larvae were common in collections on all 17 cruises, but most larvae (64.7%) were collected in summer. No callionymids were identified to species. Larvae were widespread over the north-south extent of the survey area and most (86.5%) were collected at stations < 50 m deep. Although they were not identified, the kinds of callionymids that occurred offshore were observed to differ from those taken at nearshore stations.

71. Scombridae (1,266 larvae; 7 genera; 9 species)

Scombrid larvae were common in spring and summer. Three species were observed most frequently and appear to be of near equal abundance in the eastern Gulf; they are Euthynnus alletteratus, Auxis sp. and Thunnus atlanticus. Larvae of T. thynnus were observed in each spring cruise, confirming the importance of the eastern Gulf as a spawning area for this species. Few larvae of Scomberomorus cavalla were collected, indicating that this species does not use the eastern Gulf as a major spawning area.

Auxis sp. (324 larvae)

Auxis larvae, possibly a single species, occurred on 12 cruises. Some larvae were observed in all seasons but most (77.5%) were collected in summer when there was a clear peak in their abundance each year (Figure 117). Auxis sp. larvae were among the 20 most abundant, identified species on six cruises, when mean abundances ranged from 0.6 to 5.8 under 10 m² of sea surface. Occurrences of Auxis sp. were recorded from all parts of the survey area, except the northeast corner (Figures 118 and 119). Larvae occurred at stations as shallow as 9 m, but most occurrences (> 80%) were at stations > 50 m deep. More than 50% of the Auxis sp. occurrences were between the 50 and 150 m isobaths.

Euthynnus alletteratus (361 larvae)

Larvae of the little tunny were the most frequently observed scombrid larva in our collections. They occurred on 10 cruises. Except for a single occurrence in winter (8B7201-GE7202), all larvae were collected in spring and summer (Figure 120). Little tunny larvae were among the 20 most abundant, identified species on six cruises, when mean abundances ranged from 0.7 to 6.5 under 10 m². Distribution of E. alletteratus was as widespread as that of Auxis sp. Occurrences of E. alletteratus were recorded at stations as shallow as 18 m, but most (65%) were at stations where depth was > 50 m (Figure 121 and 122). More than 55% of the E. alletteratus larva occurrences were between the 30 and 100 m isobaths, indicating that this species, on average, occurs at shallower depths than does Auxis.

Thunnus spp. (318 larvae)

Two species of Thunnus were identified. Larvae of the blackfin tuna T. atlanticus (187 larvae) occurred on five summer cruises and one

spring cruise. Bluefin tuna T. thynnus (122 larvae) occurred on four May cruises.

Blackfin tuna larvae occurred in much the same areas and same seasons as did E. alletteratus and Auxis sp. Peak abundances were recorded in summer (Figure 123). For four cruises T. atlanticus larvae were among the 20 most abundant, identified species, when mean abundance in the survey area ranged from 2.6 to 6.4 under 10 m². Larvae were widely distributed, but most occurrences were at stations > 50 m deep (Figures 124 and 125). Only six occurrences, all in the southern half of the survey area, were observed at stations < 50 m deep. Most occurrences (65%) were at stations between the 50 and 200 m isobaths. In summer, abundances of T. atlanticus, E. alletteratus and Auxis sp. all were moderately high and nearly equal (Figures 117, 120 and 123), indicating that spawning adults are abundant in the eastern Gulf.

Bluefin tuna larvae were collected only on May cruises, indicating a short spawning season for this species. On two of the May cruises (GE7208 and IS7308), larvae of T. thynnus were among the 20 most abundant species in the survey area, their mean abundances being 17.2 and 7.4 larvae under 10 m². No occurrences of bluefin tuna larvae were made at stations < 50 m deep and most occurrences were at stations > 100 m deep (Figure 126).

Katsuwonus pelamis (39 larvae)

Larvae of skipjack were collected on five cruises in spring and summer. They occurred far offshore. A single occurrence was recorded at a station < 100 m deep and 75% of all occurrences were at stations where depth was > 150 m (Figure 127).

Scomberomorus spp. (104 larvae)

Larvae of Spanish mackerel, S. maculatus (97 larvae) were relatively common but those of king mackerel, S. cavalla (6 larvae) were uncommon in our eastern Gulf collections. Spanish mackerel larvae were observed on six cruises in spring and summer. Some occurrences of S. maculatus were observed along the entire Florida Gulf coast (Figure 128). All occurrences were at stations < 50 m deep and most occurrences were at stations < 20 m deep. Larvae of S. cavalla were collected on only three cruises in summer and fall. All except one occurrence were at stations < 50 m deep.

Scomber japonicus (11 larvae)

Chub mackerel larvae were uncommon in our eastern Gulf catches. Occurrences were recorded on three winter cruises and one spring cruise. Of the seven station occurrences, five were at stations > 50 m deep and the remaining two were at stations near the 50 m isobath.

Acanthocybium solanderi (2 larvae)

Single occurrences of wahoo larvae, one in spring (GE7208) and one in summer (GE7205) were recorded at two stations > 100 m deep.

72. Gempylidae (79 larvae; 3 genera; 3 species)

Gempylid larvae occurred on 14 cruises. Most could not be identified to species. Larvae occurred in all seasons but largest numbers (73.4%) were collected in summer and fall. Occurrences were observed in both the northern and southern half of the survey area. All larvae were collected at stations > 50 m deep. Two larvae of Nesiarchus nasutus were identified, one in winter (GE7101) and one in fall (IS7320). A single Nealotus tripes was collected in winter (IS7303), and one Gempylus serpens was collected in fall (IS7320).

73. Trichiuridae (10 larvae, 1 genus, 1 species)

A few cutlassfish larvae were collected in fall, winter and spring on five of the cruises. All larvae were identified as Diplospinus multistriatus. Seven of the larvae (70%) occurred in the southern half of the survey area and all were collected at stations where depth is > 50 m.

74. Istiophoridae (2 larvae; 1 genus; 1 species)

Only two billfish larvae were collected. A single sailfish Istiophorus platypterus occurred on cruise IS7308 at a station > 200 m deep. The other unidentified istiophorid was collected on cruise IS7205 at a station > 100 m deep. Larvae of billfishes probably are more common in the eastern Gulf than indicated in our survey. Billfish larvae are relatively uncommon, inhabit the sea surface and are agile swimmers. They probably are not effectively sampled by the bongo net gear used in this survey. Such larvae sometimes can be collected in relatively large numbers with neuston nets, although the catches in this gear are difficult to quantify.

75. Stromateidae (37 larvae; 1 genus; 2 species)

Two species of butterfishes were collected. Peprilus paru (25 larvae) was collected on four cruises in summer and fall. Larvae were distributed along the entire north-south extent of the survey area, where all occurrences except one were at stations < 30 m deep (Figure 129). A second species, P. burti (8 larvae) occurred on five cruises in summer, fall and winter. All occurrences of P. burti were in the northern half of the survey area and all except one occurrence were at depths > 50 m (Figure 129).

76. Nomeidae (135 larvae; 2 genera; 3 species)

Most nomeid larvae were Cubiceps pauciradiatus (104 larvae). They were collected on 11 cruises in all seasons. Most of the C.

pauciradiatus larvae (93.3%) were taken in spring and summer cruises. All except three occurrences of C. pauciradiatus were at stations where depth exceeded 50 m; the three exceptions were in the southernmost part of the survey area (Figure 130). The second most common species was Psenes pellucidus (12 larvae). Occurrences were observed on seven cruises in all seasons; there was no apparent seasonality in the few occurrences. All occurrences were at stations > 50 m deep (Figure 131). Psenes cyanophrys (7 larvae) was observed on two cruises in winter and spring. Larvae occurred at three stations > 50 m deep.

77. Ariommidae (95 larvae; 1 genus)

Driftfishes, Ariomma spp., were collected on 12 of the 17 cruises. They occurred in all seasons. These larvae could not be identified to species. Most Ariomma spp. larvae (72.7%) were collected in the southern half of the survey area and 91.6% of the larvae occurred at stations > 50 m deep.

78. Gobiidae (21,621 larvae)

The gobies were the second most frequently observed family of larvae in the eastern Gulf. Only clupeid larvae were more frequently observed. No attempt was made to identify goby larvae because of the uncertain taxonomy of larval stages in this family. Because these larvae are a dominant kind in the eastern Gulf, a detailed systematic study to identify the species would be an important undertaking.

Larval gobies were always among the 10 most frequently observed families in the 17 cruises. They were the most frequently observed family on seven of the cruises. Gobies were common in all seasons but most (78.4%) were collected in spring and summer. Larvae were abundant in both the northern and southern sectors of the survey area. Most goby larvae (69.9%) were collected at stations < 50 m deep, but larvae were common at offshore stations and estimated abundances (number under 10 m^2) usually were higher at the offshore (> 50 m) than at onshore stations. If one family of fish larvae were chosen that characterized ichthyoplankton samples from the eastern Gulf, the Gobiidae would be the best representative family.

79. Microdesmidae (39 larvae; 1 genus)

Larvae of wormfishes, Microdesmus spp., were collected in spring on three cruises. All, except one larva, were collected at stations < 50 m deep.

80. Scorpaenidae (2,066 larvae)

Scorpionfish larvae were the seventeenth most frequently observed family. Many of the larger specimens probably could have been identified to genus, but because many species occur in the eastern Gulf and their larval taxonomy is unknown, no effort was made to identify these larvae other than at the family level. Larval scorpaenids were collected on all 17 cruises. Most of the larvae (75.0%) were taken in

spring and summer, but they were common at other seasons. Larvae were widely distributed over the shelf in the eastern Gulf; they were more commonly collected in the southern half of the survey area (60.9% of larvae) than in the northern half. Although scorpaenid larvae were more frequently observed at stations < 50 m deep (54.4% of larvae), estimated abundances (number under 10 m²) were greatest over deeper shelf waters.

81. Triglidae (2,230 larvae)

Triglid larvae were collected on all 17 cruises. There was no apparent seasonality in their occurrences. They were the sixteenth most frequently observed family of larval fishes. No triglid larvae were identified to species. Occurrences were common in both the northern and southern halves of the survey area. Most of the larvae (79.0%) were collected at stations < 50 m deep but abundances (number under 10 m²) were slightly higher at stations > 50 m deep.

82. Dactylopteridae (1 larva; 1 genus; 1 species)

One larva of Dactylopterus volitans was collected on cruise IS7308 at a station > 50 m deep.

83. Bothidae (9,165 larvae; 9 genera; 11 species)

Some kinds of bothid larvae were collected on all 17 cruises. Larval bothids occurred from nearshore to the deepest stations that were sampled. They were the third most frequently observed family of larvae in the eastern Gulf. Bothids were among the 10 most frequently observed families of larvae on 14 of the 17 cruises. Three species were particularly common; they are Syacium papillosum, Bothus robbinsi and Etropus rimosus. Larvae of those three species accounted for 77.6% of all bothid larvae that were collected. Larvae of four Citharichthys species accounted for another 17.2% of the bothids.

Using part of the data from these cruises, Dowd (1978) presented a detailed account of the distribution and abundance of larval Bothidae in the eastern Gulf during 1971 and 1973. She also discussed larval ecology and adult abundances, and she illustrated some species of bothid larvae that were previously undescribed or poorly known. Because they are frequently collected, relatively easy to identify and their distributions in the eastern Gulf are now well documented, this family is one that could be used to identify possible changes in eastern Gulf ichthyoplankton at some future date. Larvae of Syacium papillosum and Citharichthys cornutus, both of which were common in our survey, also were among the most common adult fishes collected in bottom trawl samples on BLM eastern Gulf of Mexico cruises (Alexander et al., 1977).

Citharichthys spp. (1,580 larvae)

Four species of Citharichthys were collected; they are C. cornutus, C. gymnorhinus, C. macrops and C. spilopterus.

Citharichthys cornutus (585 larvae) was collected on 15 of the cruises. It occurred at all seasons but most larvae (83.6%) were taken in spring and summer (Figure 132). Larvae of C. cornutus were among the 20 most frequently identified larvae on 11 cruises and were among the 20 most abundant species on 12₂ cruises, when mean abundances ranged from 1.0 to 9.7 larvae under 10 m² of sea surface. Most of its larvae occurred at offshore stations; 55% of the C. cornutus occurrences were at stations > 100 m deep. A few occurrences were recorded at stations < 50 m deep. Larvae were collected along the entire north-south extent of the survey area (Figures 133 and 134). Larvae of C. gymnorhinus (342 larvae) were collected on 14 cruises. They were present in all seasons with no apparent marked differences in seasonal abundance (Figure 135). Citharichthys gymnorhinus larvae were among the 20 most frequently identified species on eight cruises and were among the 20 most abundant species on six cruises, when their mean abundance ranged from 1.9 to 5.1 larvae under 10 m². Like C. cornutus, larvae of C. gymnorhinus usually were collected at stations > 50 m deep. However, only 27% of the C. gymnorhinus larval occurrences were at stations > 100 m deep (Figures 136 and 137). Larvae of C. macrops (637 larvae) occurred on all 17 cruises with no apparent differences in seasonal abundances (Figure 138). They were among the 20 most observed species on 13 cruises and among the 20 most abundant species on 10 cruises when their mean abundances ranged from 0.4 to 2.2 larvae under 10 m². Larvae of C. macrops were collected along the entire north-south extent of the survey area and > 95% of the occurrences were at stations < 50 m deep (Figures 139 and 140). No C. macrops larvae were collected at stations beyond the 200 m isobath. Relatively few C. spilopterus (12 larvae) were collected. They occurred on only two cruises; 11 larvae were collected on summer cruise 8C7120-TI7121 and one larva was observed on a winter cruise, GE7101. Three of the four station occurrences for C. spilopterus were at depths > 100 m; the single winter occurrence was at a station only 25 m deep, near the Dry Tortugas where isobaths converge rapidly.

Cyclopsetta fimbriata (84 larvae)

Larvae occurred on 14 of the 17 cruises. Although not common compared to other bothids, a few larvae were taken on most cruises. The majority (84.5%) occurred in spring-summer cruises. The distribution of C. fimbriata was widespread in the eastern Gulf (Figure 141). More than 70% of all occurrences for this species were at stations < 50 m deep but they were collected frequently at deeper stations.

Etropus rimosus (1,843 larvae)

This species was the third most frequently collected bothid larva in the eastern Gulf. It occurred on all 17 cruises but was most frequently observed in winter and spring, when a distinct spawning peak must occur (Figure 142). Larvae of E. rimosus were included in the 20 most often observed, identified species on 11 cruises and in the 20 most abundant species on 10 cruises, when their mean abundances ranged from 0.7 to 19.2 larvae under 10 m². The larvae were collected

throughout the shelf area, with only two occurrences recorded beyond the 200 m isobath (Figures 143 and 144). More than 65% of the occurrences were at stations < 50 m deep and > 95% were included within the 100 m isobath. Occurrences in summer months tended to be at stations of relatively great depth compared to occurrences at other seasons when a wider distribution was observed.

Syacium papillosum (3,317 larvae)

This species is one of the most frequently collected and widely distributed larval fish in the eastern Gulf of Mexico. Larvae of S. papillosum, the most common bothid, occurred on 16 of the 17 cruises; it was absent on cruise CL7405 when only nearshore stations were sampled. Syacium papillosum larvae were most common in summer, common in fall and spring, and least common in winter (Figure 145). They were among the 20 most frequently collected, identified species on all 16 of the cruises in which they occurred and they were included among the 20 most abundant species on 15 of the cruises, when mean abundances ranged from 2.2 to 54.9 under 10 m². Larvae were collected at stations as shallow as 5 m and as deep as 2,835 m (Figures 146 and 147). Fifty-two percent of the S. papillosum occurrences were at stations < 50 m deep and 83% were at stations < 100 m deep. Larvae were observed over the entire north-south extent of the survey area, but they were found only in the southern one third of the area during winter, indicating that spawning is restricted to that area during the coldest months.

Bothus robinsi (1,955 larvae)

This was the second most common bothid larva collected in the eastern Gulf. It occurred on all 17 cruises. There were no clear peaks of seasonal abundance (Figure 148), but abundances were highest and larvae most frequently collected in summer and fall. Bothus robinsi larvae were among the 20 most frequently observed and 20 most abundant species on all 17 cruises. Their mean abundance ranged from 0.04 to 24.5 under 10 m². Larvae of B. robinsi occurred at stations throughout the eastern Gulf (Figures 149 and 150). They were collected at stations only 5 m deep and at stations > 3,000 m deep. Forty-nine percent of the larval occurrences were at stations < 50 m deep and 81% at stations < 100 m deep.

Other bothids (55 larvae)

Monolene sessilicauda (19 larvae) occurred on seven cruises in all seasons. There was no evidence of changes in its seasonal abundance. Larval occurrences were observed at stations as shallow as 35 m but 81% of the occurrences were at station depths > 50 m. Trichopsetta ventralis (2 larvae) was collected at a single station > 50 m deep on cruise 8C7120-TI7121. Larvae of Engyophrys senta (12 larvae) occurred on three summer cruises. The five station occurrences were all at depths > 50 m. Paralichthys spp. (22 larvae) occurred on six cruises in fall, winter and spring. All Paralichthys larvae occurred at stations < 30 m deep. Catches probably would have been higher if more stations < 10 m deep had been sampled in the survey

because bothids in this genus apparently spawn in nearshore, coastal waters.

In addition to the identified Bothidae, a large number (331 larvae) could not be identified beyond the family level. Some of these larvae may have been Ancyclopsetta spp. or Gastropsetta spp., but the majority were small or mutilated larvae which, because of their condition, could not be identified.

84. Pleuronectidae (1 larva)

A single pleuronectid flatfish larva was collected on cruise IS7303 at a station > 50 m deep. This specimen, though not identified, possibly is Poecilopsetta beani.

85. Soleidae (41 larvae; 2 genera; 2 species)

Achirus lineatus (27 larvae) was collected on nine cruises. Larvae occurred in spring and summer, except for a single larva collected on a winter cruise (8B7201-GE7202). Larvae of A. lineatus occurred at stations < 50 m deep, with the single exception of the one larva collected in winter (Figure 151). More than 80% of all A. lineatus occurrences were at stations < 15 m deep. Gymnachirus melas (12 larvae) occurred on five cruises; it occurred in all seasons but was most common in spring. All except a single occurrence of G. melas were from stations < 50 m deep (Figure 151). Most occurrences of G. melas were at depths greater than those where A. lineatus were collected. The two species apparently overlap little in their spawning areas in the eastern Gulf.

86. Cynoglossidae (815 larvae; 1 genus)

Larvae of tongue soles were collected on 16 of the 17 cruises. All larvae are in the genus Symphurus but none could be identified to species. They occurred in all seasons but were most common in spring and summer when 91.7% of their larvae were collected. Larvae were taken over a broad area in the eastern Gulf, but they were more frequently collected in the southern half of the survey area (65.0%) than in the northern half. Most of the larvae (80.1%) were collected at stations < 50 m deep.

87. Balistidae (2,808 larvae)

Filefishes and triggerfishes were the thirteenth most common family of larvae in our collections. No attempt was made to identify them to species. Several species are represented in the samples. Balistid larvae occurred on all 17 cruises but most of them were collected in spring-summer (86.4%). They occurred throughout the survey area, although more larvae (62.7%) were taken in the southern half than in the northern half of the area. Most larvae were collected at stations < 50 m deep (76.6%), but estimated abundances (number under 10 m²) were greater at offshore stations.

88. Ostraciidae (3 larvae)

Three ostraciid larvae were collected on two summer cruises (8C7120-TI7121 and GE7210). Larvae were not identified to species. They occurred in the southern half of the survey area at stations < 50 m deep.

89. Tetraodontidae (1,139 larvae)

Puffer larvae were common in the eastern Gulf. Most of the larvae were Sphoeroides spp., but no attempt was made to identify them to species. Larval puffers were collected on all 17 cruises. They were most common on spring cruises, but no clear differences in seasonality were apparent. Larvae were widely distributed; although most larvae (65.6%) were collected at stations < 50 m deep, abundances (number under 10 m²) were similar between the < 50 m and > 50 m depth zones.

90. Diodontidae (2 larvae)

Two diodontids, not identified to species, occurred on two cruises, one in summer (8C7120-TI7121) and one in spring (GE7208). Both larvae occurred at stations > 50 m deep.

91. Gobiesocidae (23 larvae)

A few gobiesocids were collected on five cruises. Occurrences were recorded in fall, winter and spring. Larvae were most common (69.6%) in the northern half of the survey area and all occurrences were at stations < 50 m deep.

Estimated Annual Abundances and Apparent Mortality

An estimate of the number of larvae of each species in the survey area by 0.5 mm length-classes was provided by the ELSUM program output. Using the procedure described by Houde (1977a) the annual production of larvae in each length class was estimated for selected species. The decline in estimated production (i.e., annual abundance) as length increased was a measure of apparent mortality. From the exponential regression of annual abundance on length, the instantaneous rate of decline was estimated. The mortality coefficient that was obtained is useful to estimate the abundances of larvae in length-classes that are fully retained by meshes of the sampling gear and in which relatively little avoidance behavior by the larvae occurs. Percent mortality between the smallest and largest categories of larvae that hopefully meet the assumptions can be a useful index of annual variations in overall abundance and in larval survival rates. Changes in the eastern Gulf of Mexico environment presumably would have an impact on larval production and perhaps survival. Future ichthyoplankton surveys, conducted with the gears and methods that we employed, possibly could detect effects of environmental change by comparing abundances and apparent mortalities with data from our 1971-1974 survey.

Estimates of abundance and mortality for 26 species of larvae that are important ecologically or economically in the eastern Gulf are

given in Table 40. The declines in abundance over the length classes used in the analyses and the fitted regressions are illustrated in Figures 152-174. The mortality coefficients can be meaningfully compared among years for the same species. For species with similar morphology and growth rates, it also is interesting to compare the coefficients among species. In some cases, when annual data were not adequate to obtain good estimates, a pooled estimate of mortality and abundances over two or more years was made. Information for some of the clupeids came from published accounts in Houde (1977a, 1977b, 1977c). Carangid estimates were previously given by Leak (1977). His estimates have been updated for this report by inclusion of additional data. Some of the 1973 estimates for Bothidae are from the thesis by Dowd (1978).

Annual estimates of the rate of decline in abundance (the mortality coefficient in Table 40) usually were similar among years for those species where yearly estimates were available. In only one species could the annual mortality coefficient estimates be shown to differ among years. Bregmaceros Type B had a significantly lower rate of decline ($P < .05$) in 1972 than in 1971 and 1973. Some other species had relatively large differences in the mortality coefficient among years (e.g., Benthosema suborbitale), which possibly are real, but variability in the data and the relatively few data points to which the regressions were fit (Figures 152-174) made it impossible to judge the coefficients significantly different at the $\alpha = .05$ level.

Each of the major taxonomic groups (orders and families) that was included in this analysis seems to have a characteristic apparent mortality rate. The observed instantaneous rates of decline per mm of growth may be a function of the rates of growth in length of larvae that we selected for the analysis. The means of the apparent mortality coefficients (from Table 40 data) for the taxa used are:

Clupeiformes	
Clupeidae	$\bar{Z} = .3909$
Salmoniformes	
Gonostomatidae	$\bar{Z} = .3947$
Pleuronectiformes	
Bothidae	$\bar{Z} = .4454$
Gadiformes	
Bregmacerotidae	$\bar{Z} = .6244$
Myctophiformes	
Myctophidae	$\bar{Z} = .7313$
Perciformes	
Serranidae	$\bar{Z} = .8372$
Scombridae	.9651
Pomadasyidae	1.0730
Carangidae	1.0957

Long-bodied larvae, like the Clupeidae, usually grow relatively fast in length and thus sustain relatively small losses per mm of growth. The more robust larvae, like those in Perciformes, usually grow relatively slowly in length (but may add big increments of weight per unit length) and thus have high apparent mortality rates. The apparent mortality rates when considered as percentage losses per mm of growth $(1 - e^{-2}) \cdot 100$ show that the Clupeidae sustain an average of 32.4% loss per mm of growth, the Gonostomatidae a 32.6% loss, the Bothidae a 35.9% loss, the Bregmocerotidae a 46.4% loss, the Myctophidae a 51.9% loss and the families of perciforms a 56.7 to 65.8% loss per mm of growth.

Although the mortality coefficients usually were not significantly different among years for the species in Table 40, there were great differences in estimated abundances (annual production) of some species for the length-classes used in the analysis. Because larvae in the largest length-class for which abundance was estimated were nearing size at transformation, the annual differences in those abundance estimates may be an index of differential larval production among years. For Sardinella anchovia, the estimated number of 15.5 mm SL larvae produced in 1972 was 21 times greater than estimated production in 1971 (Table 40). For the other clupeids, estimated abundances at 15.5 mm SL differed among years by only a factor of three. For the gonostomatid, Maurollicus muelleri, estimated production of 10.5 mm SL larvae in 1973 was 8.5 times as great as 1972 production. For the two myctophids, Myctophum nitidulum and Benthosema suborbitale, annual estimates differed by factors of 2.4 and 3.5, respectively. For the Bregmacerotidae, there were relatively small differences in estimated annual production for Bregmaceros atlanticus (3.5 times) and Bregmaceros Type B (1.8 times), but Bregmaceros Type A was very abundant in 1972 when its estimated abundance at 7.3 mm SL exceeded 1971 abundance at that length by a factor of 22. The serranid, Diplectrum formosum, differed in estimated annual production at 7.8 mm SL by only a factor of 2.1 among the three years. The carangid, Decapterus punctatus, differed in production at 9.3 mm SL by a factor of 2.9 among the three years. For bothids in the genus Citharichthys, annual production estimates differed only by a factor of 2.8 for 13.5 mm SL C. cornutus and 2.7 for 9.5 mm SL C. macrops, but C. gymnorhinus at 11.5 mm SL was 7.5 times more abundant in 1973 than in 1971. The remaining bothids, Etropus rimosus, Syacium papillosum and Bothus robinsi had maximum differences in annual production that ranged from 2.7 to 3.2 for the lengths used in the analysis.

Variations in annual abundances of larvae (Table 40) are not necessarily indices of differences in annual recruitment for these species. In addition to the problem of obtaining accurate and precise estimates because of sampling variability, many of the species collected in the eastern Gulf have open-ended distributions (i.e., only a part of the potential recruit population was sampled). Also, the length of larvae at which annual production was estimated was less than that at which year-class size probably is fixed. The analysis does show that most species in the eastern Gulf vary annually in estimated abundance during the late larval stages by a factor of 2.0 to 3.5 times and that occasional larger fluctuations in abundance (5.0 to 25.0 times) can be observed. The estimated abundances and their yearly variations that we observed can be

used in future ichthyoplankton surveys to determine if significant changes in either absolute abundance or apparent survival have occurred for fish larvae in the eastern Gulf of Mexico.

Biomass Estimates

Biomasses were estimated for a few species from either their egg or larval abundances. Relatively few estimates were made because fecundities were unknown for most species and asynchronous spawning by many species made it impossible to determine the spawning season. Estimates for clupeid species were made on previous Sea Grant - supported research (Houde, 1977a, 1977b, 1977c) and are summarized in this report. The 1973 estimate for the bothid, Syacium papillosum, is from Dowd's (1978) thesis, which was written while she participated in the BLM project. The 1971 and 1972 S. papillosum estimates, the estimates for the carangids, Decapterus punctatus, and Trachurus lathami, and those for bluefin tuna, Thunnus thynnus, were made specifically for this report.

Based on the sample of biomass estimates that we have made (Table 41) and the known relative abundances of larvae in the eastern Gulf, it is apparent that most of the common species have biomasses < 100,000 metric tonnes in the survey area. Some of the clupeids and the carangid, D. punctatus, have biomasses in the 100,000 - 700,000 metric tonnes range, but it is doubtful that any species in the eastern Gulf has a biomass of one million metric tonnes. Some of the estimates that were based on larvae (Table 41) are minimal biomass estimates. Biomass estimates for Spanish sardine Sardinella anchovia were not made but, based on larval abundances and probable similar fecundity to Atlantic thread herring Opisthonema oglinum, biomasses of the Spanish sardine probably exceed 200,000 metric tonnes.

A relatively large biomass of bluefin tuna T. thynnus was estimated in 1972 and 1973 (Table 41). This estimated biomass is for a migratory population that is present in the Gulf only from February through May when it spawns. Thus, the biomass is a concentrate of an Atlantic population that is more dispersed at other seasons; it also is only a partial estimate of the biomass in the Gulf of Mexico, because most of the spawning bluefin population is not in the area represented by our ichthyoplankton survey.

The small bothid flatfish, Syacium papillosum, was the most abundant juvenile or adult fish sampled in bottom trawls as part of 1975-76 MAFLA-BLM research (Alexander et al., 1977) and in the Florida Department of Natural Resources HOURGLASS cruises (Topp and Hoff, 1972). Its mean estimated biomass for 1971-1973, based on our larval production estimates, is 102,694 metric tonnes in the eastern Gulf survey area. Larvae of two other bothid species, Bothus robinsi and Etropus rimosus, were nearly as common as S. papillosum larvae in the eastern Gulf. No fecundity estimates were available for those species but, assuming that their relative fecundity is equal to that of S. papillosum (i.e. 690 ova g⁻¹), then the following biomasses, averaged for 1971 - 1973, are probable: B. robinsi -- 69,319 metric tonnes; E. rimosus -- 62,724 metric tonnes.

Diversity

Ichthyoplankton in the eastern Gulf of Mexico is relatively diverse. Only 41.7% of the larvae that were collected on the 17 cruises were identified to species, but the 59,701 specimens that were identified included 173 species. If we had been able to identify species in many of the abundant families whose larvae are undescribed (e.g., Gobiidae, Ophidiidae, Synodontidae, Scorpaenidae), the number of species present would be more than double that which we report. As in most communities, a relatively few species dominate the ichthyoplankton of the eastern Gulf of Mexico. The 20 most frequently collected, identified species totaled 53,394 larvae (Table 42), which is 89.4% of all larvae that were identified to species and 37.3% of all larvae that were collected. Within the 20 most common species list, the Clupeidae (4 species), Bothidae (5 species), Serranidae (3 species) and Carangidae (2 species) contained the most individuals (47,031). The four clupeid species alone totaled 28,561 larvae. Other common species certainly are present in the unidentified part of our collections, but based on present knowledge, the 20 species listed in Table 42 comprise the dominant identifiable larvae.

Because the most common species occur in different depth zones, the observed catches, before being standardized to a unit area of sea surface, are not always good indicators of true abundance (i.e., infrequently collected larvae that occur in deep water may be abundant relative to commonly collected larvae that occur in shallow depths. Thus, mean abundances (as numbers under 10 m²) over the 17 cruises of the 20 most often collected species were calculated for < 50 and > 50 m depth zones as well as North and South sectors of the survey area (Table 43) as indices of true abundance. When presented this way it is clear that species which are found offshore often have higher abundances than their ranked order of occurrence in catches (Table 42) would indicate (e.g., compare Myctophum nitidulum to Harengula jaguana). Also, in some instances the estimated abundances (numbers under 10 m²) of species vary greatly among North and South sectors (e.g., Opisthonema oglinum), often more than the observed numbers in catches might imply. In estimating diversity of ichthyoplankton in the eastern Gulf, where station depths varied from < 10 m to > 3000 m, it was necessary to consider species' abundances rather than occurrences to gain a good understanding of how the numbers of species and individuals in those species varied seasonally, annually, and among sectors of the survey area.

A taxocene of 94 species was designated for consideration in all diversity estimates. Those species and the ranges of surface temperatures, surface salinities and station depths where they were collected are listed in Table 44. The taxocene consists of species for which 10 or more individuals were collected on the 17 cruises and for which larvae of all sizes were recognized. Thus, although relatively large specimens of Rhomboplites aurorubens were observed more than 10 times, this species is not in the taxocene because its smallest larvae could not be distinguished from those of other lutjanids.

The number of species in the taxocene that was observed at individual stations is one measure of diversity. The frequency distributions of stations at which numbers of species were observed were examined for the five 1973 cruises, when sampling effort was nearly equal on each cruise (Table 45). For species in the taxocene, the modal class over all cruises is 4-7 species per station (50% of all occurrences fall in this class). Mean numbers of taxocene species per station range from 6.04 to 7.69 for the five cruises with highest values occurring in spring and summer. The maximum number of taxocene species that was observed at a single station was 21 species on cruise IS7308. The frequency distribution of stations that yielded observed numbers of species differed between the < 50 and > 50 m depth zones (Table 45). More taxocene species per station usually were observed at the > 50 m depth stations. Mean numbers per station ranged from 4.33 to 6.65 at < 50 m deep stations but were 9.17 to 10.41 at > 50 m deep stations. Part of the difference in numbers of taxocene species observed per station in the two depth zones resulted from differences in our ability to identify larvae that occur in the two zones, but the result mostly reflects the greater diversity of species that is present in offshore waters of the eastern Gulf.

Estimates of diversity for each cruise were made (Table 46). The species richness component (R) was calculated only for IS7209 and all 1973 cruises, when the sampling plan was uniform. Values of H' , J and C were plotted (Figure 175) to show any seasonal or annual trends in diversity which might indicate progressive changes in the ichthyoplankton community. Values for cruise GE7210 were not plotted because only 13 stations, all nearshore, were sampled on that cruise and the estimated coefficients probably misrepresent the real diversity in the ichthyoplankton at that time. For the 16 remaining cruises, only the IS7205 and CL7412 diversities diverge noticeably from the others. Low diversity on those cruises resulted from higher than usual catches of clupeid larvae, particularly Sardinella anchovia. The dominance of the ichthyoplankton community by this species is best shown by Simpson's index (C), which indicates that there was an approximate 25-35% probability of randomly picking in sequence two larvae of the same species from the collections of those two cruises.

The evenness component (J) of diversity measured the evenness of distribution of individuals among the species that were sampled. Values of J are proportions of the maximum possible diversities for s species (i.e., $H'_{\max} = \log_e s$), which would be observed if all species were equally abundant. The mean values of J were compared among three years, 1971, 1972, and 1973 in an analysis of variance, in which the variables were the individual cruise estimates of J (Table 47). Mean values of J ranged from .6641 in 1972 to .7080 in 1971. The mean diversities did not differ significantly among the three years ($P > .50$). An analysis of variance on the evenness coefficients also was run to determine if mean ichthyoplankton diversity differed among seasons (Table 48). Mean coefficients ranged from a low value of .6070 in summer, when clupeid, bothid and carangid dominance was most evident, to a high value of .7073 in fall. The mean seasonal, evenness

coefficients were not judged to differ significantly ($P > .50$). Within season variability was relatively high compared to any seasonal differences in mean ichthyoplankton diversity. The mean numbers of taxocene species that were collected in each season were similar except in winter when fewer species were observed. The means were: winter -- 42.5 species; spring -- 57.2 species; summer -- 53.0 species (excluding cruise GE7210, which was not representative); fall -- 54.3 species.

Because the mean annual and seasonal evenness coefficients were not significantly different, the pooled mean coefficient for 1971-73 cruises, exclusive of cruise GE7210, may be the best estimator of larval diversity. The two 1974 cruises also were excluded because no (CL7405) or few (CL7412) offshore stations were sampled. The pooled mean evenness coefficient is $J = .6927$. With .95 probability, J ranges from .6528 to .7326. Future ichthyoplankton survey work in the eastern Gulf, in which the same taxocene is examined, can refer to that value to judge if significant changes in diversity have occurred. The value might also be a useful point of reference for ichthyoplankton surveys in other areas for comparing relative diversities, but this would only be true if the same or similar taxocene were available in the two regions.

When the northern and southern sectors of the survey area were compared, there were no clear differences in diversities between the two sectors. The Shannon-Weaver coefficient (H') was higher on most cruises in the southern sector and the Simpson coefficient (C) usually indicated higher species dominance in the northern sector (Table 49; Figure 176). The mean number of taxocene species collected per cruise was higher in the southern sector (48.2 species) than in the northern sector (40.4 species). The greater availability of species in the southern sector can be seen for the six cruises where species richness (R) was calculated (Table 49). It is higher in the south in four of the six cases. Despite an apparent higher diversity in the southern sector there were no significant differences among sectors for 10 cruises in which the evenness coefficients (J) could be compared in a paired- t test ($P > .50$) (Table 50). Evenness was highest in the North on four cruises and in the South on six cruises. More species apparently are present in the southern sector but the abundances of individual species of larvae are distributed with equal evenness among species in both sectors.

Diversity in the ichthyoplankton was highest at offshore stations. All of the coefficients that were calculated reflected the relatively diverse nature of ichthyoplankton at stations > 50 m deep (Table 51; Figure 177). The mean number of taxocene species present per cruise was 44.8 at > 50 m stations but only 26.9 at < 50 m stations. For the six cruises where applicable, the species richness coefficient (R) showed a particularly good contrast in diversity between offshore and onshore zones (Table 51). A paired- t test was used to compare the evenness coefficients (J) for offshore and onshore zones in 13 cruises (Table 52). The difference in coefficient values was highly significant ($P < .002$), confirming the greater diversity in

offshore ichthyoplankton. In addition to fewer species of larvae being present at < 50 m deep stations, a few species of clupeids (e.g., Opisthonema oglinum or Sardinella anchovia) tended to dominate abundances of larvae in that depth zone, which led to relatively low estimates of ichthyoplankton diversity.

Two transects of our ichthyoplankton survey coincided with transects that were sampled as part of BLM-sponsored, MAFLA research in 1975-76 (Alexander et al., 1977). The first of these transects (MAFLA I) was offshore from Sanibel Island (latitude 26°30'N) and the second (MAFLA II) was off Tampa Bay (latitude 27°30'N). The diversity of ichthyoplankton was examined for stations on those transects.

There were no apparent differences in ichthyoplankton diversity between the Sanibel and Tampa Bay transects for 11 cruises where both transects were sampled. The mean number of taxocene species per station was 8.2 for the Sanibel transect and 8.1 for the Tampa Bay transect. A paired-t test between evenness coefficients (J) for the 11 cruises did not detect any significant differences in diversity between the transects ($P > .20$) (Table 53). Although a species by species comparison was not carried out, the species of larvae that were present on the two transects apparently were similar.

There were significant within cruise diversity differences when the North and South sectors or the < 50 m and > 50 m depth zones were compared. A t test, based on the method outlined in Poole (1974) and Zar (1974) showed that the Shannon-Weaver coefficients (H') differed significantly in every case at $P < .001$ for 13 cruises when < 50 m and > 50 m diversities were compared (Table 54). The > 50 m depth Shannon-Weaver coefficient was always higher than the corresponding coefficient for < 50 m depths, indicating that the ichthyoplankton community is more diverse offshore. Similar t tests for North vs. South diversities on 10 cruises showed 9 out of 10 within cruise comparisons to differ significantly at the $\alpha = .05$ level (Table 54). The diversity of the ichthyoplankton usually differed significantly between northern and southern sectors at the time of a cruise, but diversity was not consistently higher in either the North or South sector. In three of the cruises diversity was higher in the North sector than in the South sector.

Larval Abundances and Occurrences in Relation to Environmental Factors

Results of the simple linear correlation analyses, where the logarithm of larval abundance (number under 10 m²) at a station was correlated with surface temperature, surface salinity, station depth, latitude, and the logarithm of zooplankton volume (cm³ 1000 m⁻³), are summarized in Table 55. Only stations that had non-zero catches (i.e. positive stations) of the species being considered were included in the analyses. The analyses were run on the same 94 species that had been considered in the analysis of larval diversity. Only those species with five or more occurrences were used in any of the correlation analyses. Correlation coefficients that were significant at the .05 or .01 level are listed in the tables and non-significant correlations are

indicated by a dashed line. Results are presented in three categories: Table 55 includes pooled data from all 17 cruises; Tables 56-60 are seasonal analyses, with data pooled from cruises in the same season over all years; Table 61-77 are the correlation analyses for each of the cruises.

The most striking result of the analysis is the scarcity of significant correlations between larval abundance and the other variables that were considered. Relationships among the variables almost certainly are complex and the simple linear correlations do not detect the multiple or partial correlations that may be present. Two other factors influenced the outcome of the correlation analyses, making results difficult to interpret. The oblique net tows used in these surveys are effective to obtain integrated estimates of larval abundances over the range of depths sampled by the net, but they do not provide explicit information on depths of larval occurrence. Thus, variables such as surface temperature and surface salinity may be poor correlates of larval abundance if the larvae are not concentrated near the surface. A second factor, which particularly affected the larval abundance - surface salinity correlations, was the presence of a 15-m thick lens of low salinity water in the eastern Gulf during summer, 1973, which originated from Mississippi River flood runoff. It resulted in some significant, but probably spurious, negative correlations between larval abundances and surface salinity in correlation analyses for cruises IS7311, IS7313 and the pooled data, correlation analyses. For example, it is not likely that abundances of several species of oceanic fish larvae are significantly greater when low surface salinity conditions prevail in the eastern Gulf. It is probable that many of these larvae actually were collected from beneath the lens of low salinity water ($24 - 32^{\circ}/\text{oo}$), but in our analysis, which used surface salinity as the variable to be correlated with larval abundance, an apparent negative correlation could have resulted.

An alternative approach to determine how occurrences of the most commonly collected species of larvae were related to surface temperatures, surface salinities and station depths was taken, in which the percentage cumulative frequencies of station occurrences for the 20 most commonly identified larvae were calculated (Table 78). It is easy to judge what ranges of conditions are most often associated with occurrences of each of the species. Although only the 20 most common species are included in this tabulation, the calculations were completed for the 94 species that had been considered in the diversity analysis. Data for all 94 species are on tape and available if needed. A description of the relationships observed for the 20 most common species is presented here.

- 1.) Sardinella anchovia: Larvae occurred when surface temperatures ranged from $21.0 - 32.0^{\circ}\text{C}$, but most occurred at $24.0 - 30.0^{\circ}\text{C}$. Most larvae were collected where surface salinities were $\geq 35.0^{\circ}/\text{oo}$ and 90% of occurrences were at stations ≤ 50 m deep.
- 2.) Opisthonema oglinum: Larvae occurred at surface temperatures from $18.0 - > 31.0^{\circ}\text{C}$, but mostly at $24.0 - 30.0^{\circ}\text{C}$. Most larvae were collected at salinities $\geq 35.0^{\circ}/\text{oo}$ and most occurrences (77%) were at stations ≤ 30 m deep.

- 3.) Decapterus punctatus: Larvae occurred at surface temperatures from 20.0 - $\geq 32.0^{\circ}\text{C}$; most occurrences were at 23.0 - 32.0°C . Most occurrences were at salinities $\geq 35.0^{\circ}/\text{oo}$. The larvae were widely distributed but 90% of occurrences were at stations ≤ 90 m deep.
- 4.) Diplectrum formosum: Larvae were collected over a wide range of surface temperatures, 17.0 - $\geq 32.0^{\circ}\text{C}$. Most occurred when surface temperatures ranged from 23.0 - 29.0°C . They usually were found when surface salinities were $\geq 35.0^{\circ}/\text{oo}$ and station depths ≤ 50 m.
- 5.) Harengula jaguana: These larvae occurred at surface temperatures from 18.0 - 30.9°C , but usually occurred at 24.0 - 30.0°C . They frequently were observed (31% of occurrences) where salinities were $\leq 35.0^{\circ}/\text{oo}$, but most occurrences were at $\geq 35.0^{\circ}/\text{oo}$. Most larvae occurred at stations ≤ 30 m deep.
- 6.) Syacium papillosum: Larvae occurred at 19.0 - 32.0°C surface temperatures but most occurrences were at 25.0 - 31.0°C . They usually occurred at surface salinities $\geq 35^{\circ}/\text{oo}$. Larvae of S. papillosum are among the most widely distributed in the eastern Gulf, but only 25% of station occurrences were recorded from depths ≥ 71 m.
- 7.) Bregmaceros Type B: Larvae were collected at surface temperatures from 19.0 - 31.0°C , but most occurred when temperature was 22.0 - 28.0°C . They usually occurred at surface salinities $\geq 35.0^{\circ}/\text{oo}$. Seventy-six percent of the station occurrences of this species were at 31 - 90 m depths, but some larvae were collected at depths > 3000 m.
- 8.) Bothus robinsi: Larvae occurred at surface temperatures of 17.0 - $\geq 32.0^{\circ}\text{C}$, a wide range, but most occurrences were at $\geq 23.0^{\circ}\text{C}$. They usually occurred at salinities $\geq 35.0^{\circ}/\text{oo}$. Larvae had a widespread distribution but 56% of the occurrences were at depths from 31 - 70 m and only 26% of the occurrences were at depths ≥ 71 m.
- 9.) Etropus rimosus: Larvae occurred at surface temperatures from 16.0 - 30.9°C , with most occurrences at 22 - 28°C . They usually were collected at salinities $\geq 35.0^{\circ}/\text{oo}$. Larval occurrences were most common at stations 11 - 50 m deep, although they frequently were collected at 51 - 90 m depths.
- 10.) Maurollicus muelleri: Occurrences were observed at 21.0 - 30.9°C surface temperatures, with most being in the range 24.0 - 30.0°C . Most occurrences were at surface salinities from 31.0 - $36.9^{\circ}/\text{oo}$; the relatively high percentage of occurrences at low salinities ($< 33.0^{\circ}/\text{oo}$) reflects the very large catches made in summer, 1973, when the lens of low salinity water was present at the surface in much of the eastern Gulf. It is not known if M. muelleri larvae actually were in the low salinity lens or resided

beneath it, because discrete depth tows were not made. Ninety percent of the occurrences for this species were made at depths ≥ 91 m.

- 11.) Etrumeus teres: Larvae occurred at surface temperatures from $17.0 - 27.9^{\circ}\text{C}$, with the majority of occurrences between 20.0 and 26.0°C . Most occurrences were at salinities $\geq 36.0^{\circ}/\text{oo}$ and at depths of $31 - 70$ m, although 30% of the occurrences were at depths ≥ 71 m.
- 12.) Bregmaceros Type A: These larvae were collected at surface temperatures from $21.0 - 30.9^{\circ}\text{C}$. Most occurrences were at $24.0 - 30.0^{\circ}\text{C}$. They occurred most frequently where surface salinities ranged from $34.0 - 36.9^{\circ}/\text{oo}$. There was a majority of occurrences at depths from $51 - 110$ m, but 42% of the station occurrences were observed at $111 - > 3000$ m depths.
- 13.) Chloroscombrus chrysurus: Occurrences were observed at $24.0 - 31.9^{\circ}\text{C}$, but mostly at $27.0 - 31.9^{\circ}\text{C}$. Most occurrences were at salinities $\geq 35.0^{\circ}/\text{oo}$ and at stations < 30 m deep. Seventy-five percent of the occurrences were observed at depths ≤ 20 m deep.
- 14.) Orthopristis chrysoptera: Larvae occurred at surface temperatures from $15.0 - 25.9^{\circ}\text{C}$, with most occurrences from $18.0 - 24.0^{\circ}\text{C}$. They commonly occurred where surface salinities were $\geq 32.0^{\circ}/\text{oo}$ and at stations < 30 m deep. Seventy-five percent of the occurrences were observed at depths < 20 m.
- 15.) Citharichthys cornutus: Collections were made at surface temperatures from $21.0 - 30.9^{\circ}\text{C}$, with most at $24.0 - 30.0^{\circ}\text{C}$. These larvae usually occurred at surface salinities $\geq 35.0^{\circ}/\text{oo}$. Most larvae (78% of occurrences) occurred at stations $51 - 200$ m deep.
- 16.) Citharichthys macrops: There were occurrences of this species at surface temperatures from $17.0 - 30.9^{\circ}\text{C}$; most were at $20.0 - 29.0^{\circ}\text{C}$. They occurred most often at surface salinities from $33.0 - 36.9^{\circ}/\text{oo}$ and most occurrences were at depths ≤ 30 m.
- 17.) Myctophum nitidulum: Larvae occurred at surface temperatures from $18.0 - 30.9^{\circ}\text{C}$, but most occurrences were at $24.0 - 30.0^{\circ}\text{C}$. Surface salinities of $31.0 - 36.9^{\circ}/\text{oo}$ usually were associated with M. nitidulum occurrences. Occurrences at low surface salinities were recorded in summer, 1973; it is not known if the larvae were collected in the low salinity lens at the surface or below it where normal salinities (i.e. $\geq 35.0^{\circ}/\text{oo}$) prevailed. Eighty-six percent of the station occurrences for this species were between 51 and 1000 m depths.
- 18.) Hemanthias vivanus: Occurrences were observed at surface temperatures from $22.0 - 30.9^{\circ}\text{C}$. Most occurrences were at surface salinities $\geq 35.0^{\circ}/\text{oo}$. Most of these larvae occurred at stations in the $51 - 200$ m depth range.

- 19.) Serraniculus pumilio: Larvae occurred at surface temperatures from 22.0 - 31.0°C. Most occurrences were at salinities \geq 35.0‰. All except 3% of occurrences were from stations \leq 50 m deep and 70% were in the 11 - 30 m depth range.
- 20.) Euthynnus alletteratus: Larvae were collected at surface temperatures from 24.0 - 30.9°C, with most occurrences at 27.0 - 30.9°C. They most often occurred at surface salinities from 31.0 - 36.9‰. The occurrences of E. alletteratus at low surface salinities (\leq 33.0‰) were in summer, 1973. Larvae actually may have been captured at higher salinities below the lens of low salinity water, but the collecting method did not allow depth of capture to be estimated. Most occurrences were at stations 31 - 200 m deep.

Loop Current Effects

The Loop Current can transport significant amounts of water from the Caribbean Sea into the Gulf of Mexico and occasionally onto continental shelf areas in the eastern Gulf through intrusions of the Loop or by eddies that spin off the Loop and which are carried over the shelf (Maul, 1977). Plankton populations, including oceanic fish larvae, presumably would be transported to shelf areas and might be useful indicators of Loop Current water on the shelf and the Loop Current might be a source for recruitment of some fishes in the eastern Gulf. Our analysis examined 14 species of larvae that usually occur in offshore waters of the eastern Gulf for evidence of entrainment in the Loop Current. There was some evidence that a few of the species might be entrained, but the analysis was in some respects inconclusive. This should not be interpreted to mean that the Loop Current does not have significant effects on larval fish distribution and abundance, but that our collections and the analysis of the data may not be the best means to interpret Loop Current effects.

Six of the 14 species that were examined in the contingency chi-square analysis showed significant evidence of positive association with $> 36.5^{\circ}/\text{oo}$ water, when it was present at depths of < 50 to 100 m (Table 79). An additional four species were present in the $> 36.5^{\circ}/\text{oo}$ water at < 50 to 100 m depths in frequencies greater than expected, but their association with those conditions was not statistically significant (i.e. $P > .05$). Four of the species were negatively associated with conditions defined as Loop Current water when it occurred at < 50 to 100 m depths.

Species that showed strong affinities with Loop Current water when it was present on the shelf include, the gonostomatids, Gonostoma elongatum and Vinciguerria nimbaria; the myctophids, Myctophum nitidulum and Diogenichthys atlanticus; and the bregmacerotids, Bregmaceros atlanticus and Bregmaceros Type A. Non-significant positive association with Loop Current water on the shelf was indicated for the gonostomatid, Maurolicus muelleri, the myctophids, Diaphus spp. and Benthoosema suborbitale, and the deep-shelf, slope water serranid, Hemanthias vivanus. Species for which a negative association was apparent were the myctophid, Notolychnus valdiviae, the bregmacerotids, Bregmaceros maclellandi and Bregmaceros Type B, and the scombrid, Auxis sp. In the case of N. valdiviae and B. maclellandi, more larvae of these species were collected at $< 50 - 100$ m deep stations, where no salinities $> 36.5^{\circ}/\text{oo}$ occurred, than in areas with higher salinity (Loop Current). This unexpected outcome might suggest avoidance by these species of Loop Current water, but a more realistic guess would be that sampling variability was the causative factor. For Bregmaceros Type B and Auxis sp. the negative associations may be the result of a poor choice of species for this analysis. Both of these species, although found predominantly at depths > 50 m, are most prevalent at depths < 100 m (84% of occurrences in the case of Bregmaceros Type B and 57% of occurrences in the case of Auxis sp). Thus, they apparently are fishes that spawn over the deep shelf in the eastern Gulf and usually would not be associated with Loop Current conditions. If those two species are not considered, evidence of positive associations with Loop Current conditions are detectable for 10 of the 12 remaining species.

An example of the technique used to determine numbers of occurrences in Loop Current water is given in Figure 178. The hatched areas show the contoured estimate of presence of $\geq 36.5^{\circ}/\text{oo}$ water, indicative of Loop Current influence (SUSIO, 1975). For this cruise (8C7113-TI7114) there was a total of six occurrences of Myctophum nitidulum at ≤ 100 m depth. Four of the six occurrences at those depths were in $\geq 36.5^{\circ}/\text{oo}$ water, indicating a possible entrainment of M. nitidulum in Loop Current intrusions onto the shelf. The high salinity water shown in the southeast corner of the survey area (Figure 178) is not due to Loop Current influence but reflects the characteristic high salinity of the Everglades estuary - Florida Bay systems prior to the start of the rainy season.

DISCUSSION AND CONCLUSIONS

An abundant and diverse ichthyoplankton community was observed in the eastern Gulf of Mexico. Much of the diversity is related to the variety of pelagic habitats that were sampled in our surveys. Samples were collected in coastal areas where water depth was < 5 m and far offshore at depths > 3000 m. As a consequence, a wide variety of ichthyoplankton was sampled. A total of 91 families of fishes occurred in the samples and we identified 173 species. Many more species were present but could not be identified.

The kinds of larvae that predominated in our surveys were similar to those that were important off the Texas coast (Finucane *et al.*, 1978) and in the South Atlantic Bight (Powles and Stender, 1976). Larvae of clupeids were relatively more abundant in our eastern Gulf surveys indicating the importance of that family in this area. Other important families, such as Gobiidae, Bothidae, Carangidae, Serranidae and Bregmacerotidae also were important in the South Atlantic Bight and Texas coast studies. Bothid flounder larvae, particularly *Syacium* spp. and *Bothus* spp., were important constituents of the eastern Gulf and South Atlantic samples, but apparently were of lesser importance off the Texas coast. Larvae of Myctophidae were among the most abundant larvae in our eastern Gulf surveys but were less important in the other studies, perhaps because our surveys included a relatively high number of sampling stations at > 100 m depth. Richards (1979) reported on ichthyoplankton from two surveys in the Caribbean. Seven of his 10 most common families were the same as those from the eastern Gulf when only > 50 m deep stations are considered. The Gobiidae and Bothidae were relatively more important in the eastern Gulf than in the Caribbean. The families Synodontidae, Serranidae and Engraulidae (all coastal or shelf fishes) were among the 10 most abundant in the eastern Gulf surveys from > 50 m depths, but were not among the 10 most common families from the Caribbean surveys.

There are several species of fish larvae in the eastern Gulf which might be termed key species because of their abundance, occurrence during several months of the year, and widespread distributions. The frequent occurrences of these species in samples makes them useful as possible indicator species which could be used in the future to determine if changes in ichthyoplankton abundance and diversity have occurred in the eastern Gulf. Such changes would imply that changes in spawning success, spawning areas or larval survival had occurred. Some of the bothid larvae would be ideal for this purpose. *Syacium papillosum* larvae are consistently abundant from spring through fall in the eastern Gulf at depths from 10 m to > 200 m. This species, as juveniles and adults, was the most commonly collected demersal fish in BLM-supported surveys (Alexander *et al.*, 1977). It is an important fish in the eastern Gulf ecosystem and its availability to sampling gears at all life stages makes it a good choice as one index species for monitoring surveys. Other bothids, like *Bothus robbinsi*, *Etropus rimosus* and the complex of *Citharichthys* species also have many of the attributes required of species that might be used as reference species for future research. The only other demersal species, whose larvae

fall into the key species category, is the serranid Diplectrum formosum. The abundant larvae of this fish are virtually all confined within the 100 m isobath. It was one of the most consistently collected larvae at stations < 50 m deep and it occurs commonly from spring through fall, indicating an extensive spawning season in the eastern Gulf. Other important larvae are those whose adults are pelagic. Larvae of the carangid Decapterus punctatus are common, occur in nearly all months, and are distributed widely. Their abundances are nearly equal in < 50 m and > 50 m depth zones. Like Syacium papillosum, this species would be an excellent choice for an index species. Clupeid larvae are abundant but most of the species are not widely distributed in the eastern Gulf. Sardinella anchovia is the most widespread of the clupeids and has the longest spawning season. It, and possibly Opisthonema oglinum, can be considered key species. The abundance and consistent occurrence of two species of bregmacerotids over the outer shelf and at offshore stations was unexpected, but larvae of Bregmaceros Type B and possibly Type A, should be included on key species' lists of ichthyoplankton in the eastern Gulf of Mexico.

A fair understanding of conditions associated with spawning by many common fishes in the eastern Gulf was obtained in this study. The areas and seasons of egg and larvae occurrences are indicative of recent spawning. Houde and Chitty (1976) previously had shown that eggs and larvae of fishes were more abundant in the eastern Gulf during spring and summer than during fall and winter, indicating that peak spawning occurred during the warm months of the year. They did not identify any eggs or larvae in that report. Their conclusions were similar to those of Juarez (1975), who examined ichthyoplankton abundance on the Campeche Bank in the southwestern Gulf.

Spawning by some clupeid fishes in the eastern Gulf was discussed by Houde (1977a, 1977b, 1977c). Both Opisthonema oglinum and Harengula jaguana are spring-summer spawners and most spawning activity is confined to shelf areas where depths are < 30 m. In contrast, Etrumeus teres is a late fall-spring spawner, with most spawning occurring in mid-winter over shelf areas of 30-100 m depth. An area of peak spawning activity for E. teres was noted offshore from Tampa Bay (Houde, 1977a). In this report we analyzed occurrence data for the very abundant Sardinella anchovia larvae and found that some spawning occurred year round, but was most intense in the warmest months of the year, which agrees with observations of Juarez (1975) for S. anchovia on Campeche Bank. We also observed that larvae of S. anchovia had the most widespread distribution of any clupeid larva in the eastern Gulf. Most of its occurrences were at depths < 30 m, but it was not uncommon to collect S. anchovia larvae at 30-70 m depths throughout the north-south extent of the survey area.

The carangid Decapterus punctatus spawns over a wide area of the Gulf of Mexico (Aprieto, 1973; Montolio, 1976; Leak, 1977). Montolio (1976) collected D. punctatus larvae in all parts of the Gulf, including the central region, although she reported it to be most abundant in the northeastern Gulf. Leak's (1977) detailed study of

carangid larvae in the eastern Gulf and additional data in this report demonstrated that D. punctatus larvae dominated carangid larvae catches in that area. Larvae occurred at all depths over the shelf, but were most common at 10-70 m depths, indicating that most spawning was in shelf waters and not farther offshore. Both Leak (1977) and Montolio (1976) observed a spring spawning peak for D. punctatus; Leak also observed a major secondary peak in September 1972 and Montolio reported a secondary spawning peak by this species in the fall. Some spawning occurs year round by D. punctatus, but Leak (1977) noted that in winter (Jan-Feb) spawning was confined to areas south of latitude 26°N in the eastern Gulf.

Other carangids were less common, but Chloroscombrus chrysurus was abundant. It is a summer spawner and virtually all larvae (and presumably spawning occurrences) occurred at stations < 30 m deep in the eastern Gulf. Larvae of Trachurus lathami were the only other carangid larva observed in relatively large numbers in our surveys. These larvae, which are morphologically similar to Decapterus punctatus, occurred only in winter and early spring at stations > 50 m deep. Leak (1977) suggested that T. lathami and D. punctatus spawned at different seasons and in different areas of the eastern Gulf to prevent possible competition between their larvae for potentially limiting zooplankton prey. Information on larval occurrences and discussions of probable spawning areas by other carangid fishes in the eastern Gulf can be found in Aprieto (1973), Montolio (1976) and Leak (1977).

Spawning by the most common bothid Syacium papillosum was most intense in spring and especially summer. During the peak spawning season larvae were collected throughout the shelf survey area, with most occurrences between the 10 and 100 m isobaths, indicating that most spawning was in that depth zone. Mean abundances of larvae were highest in the southern half of the survey area and spawning was presumed to be most intense in that sector. Dowd (1978) discussed spawning by S. papillosum and larval occurrences in the eastern Gulf. She reported that the smallest length-classes of S. papillosum did not occur north of latitude 26°N in winter, which indicates that spawning continues in winter, but only in the southern one-third of the survey area. The larvae of Bothus robinsi occurred in the same seasons, areas and depths as S. papillosum, although B. robinsi were relatively more common in winter. Dowd (1978) observed that the smallest B. robinsi larvae (< 4.0 mm) were found only south of latitude 26°N in winter, indicating that spawning was restricted to that area in the coldest months. A wider distribution, similar to that in warmer months, was observed for large B. robinsi larvae in winter, which suggests that this species leads a relatively long life in the pelagic larvae stage. The third most common larval bothid, Etropus rimosus, also occurred over a wide area in the eastern Gulf, but its distribution was more restricted than were the distributions of S. papillosum and B. robinsi. Most E. rimosus larvae occurred in the northern half of the survey area and at depths < 50 m. This species spawns at times and in areas when

S. papillosum and B. robbinsi spawning activity is at lowest levels. The species of Citharichthys had varied spawning seasons and areas, which Dowd (1978) discussed in detail. Spawning by C. gymnorhinus and C. cornutus occurred mostly at depths > 50 m while C. macrops spawned most at depths < 30 m. More C. cornutus larvae, and presumably spawning, occurred in summer months, although they were common in all seasons. No seasonality was observed for C. gymnorhinus spawning activity. A winter peak in spawning activity for C. macrops was apparent, based on highest larval abundances in that season.

Some kinds of serranids spawned at all seasons and in all parts of the shelf and slope regions of the eastern Gulf. Juarez (1975) also reported spawning by serranids at all seasons on the Campeche Bank, but she observed that spawning by these fishes was confined to a narrow band of "intermediate depths." In our survey we noted seasonality associated with the spawning by serranid subfamilies. The anthiines spawned mostly over the deep shelf and slope waters in fall, winter and spring. Serranines had variable spawning seasons and some species spawned at all depths over the shelf region. Epinephelines spawned mostly in spring over shelf areas of intermediate depths (30-are spring and summer spawners, with most spawning apparently occurring over deep shelf and slope areas.

Occurrences of the abundant serranine, Diplectrum formosum, larvae indicated a year round spawning season, but a pronounced spring-summer peak in activity was observed. In winter, most larvae occurred in the southern half of the survey area. Most larvae occurred at depths < 50 m, over the entire north-south extent of the survey area, although occurrences at stations in the 100-200 m depth zone indicate that some spawning occurs over the deeper shelf waters. A second common serranine, the black seabass Centropristis striata, spawned from fall to spring, also mostly over depths < 50 m. Its larvae were most abundant in the northeast part of the survey area where spawning by this species apparently is most intense.

The only anthiine that occurred in relatively large numbers was Hemanthias vivanus. A majority of its larvae were collected in winter and spring at stations between the 50 and 200 m isobaths, although occasionally occurrences at other seasons indicated some spawning over the deep shelf and slope on a year round basis. Finucane et al. (1978) collected H. vivanus larvae off the Texas coast in July and December.

The few epinepheline larvae that were identified were Epinephelus morio. They occurred on spring cruises, indicating spawning in that season and supporting the gonad maturation analysis evidence that Moe (1969) presented, based on histological examination of E. morio ovaries.

Most lutjanids could not be identified, but the majority of snapper larvae occurred in summer, in the southern half of the survey area, at station depths from 30-100 m. Rhomboplites aurorubens is a

peak summer spawner, but some larvae were observed in all seasons. Most of the unidentified larvae probably were Lutjanus spp. and Ocyurus chrysurus, which are generally considered to be summer spawners in Florida waters.

The bregmacerotids spawn year round in the eastern Gulf. There is some segregation by species of major spawning areas, but larvae of all species occurred over the slope and deep Gulf stations. Only Bregmaceros Type B was found commonly at station depths < 50 m, where the presence of small larvae was evidence of some spawning in that depth zone. It had peak larvae abundance in fall, when spawning activity is highest. There were no indications of seasonality in occurrence of larvae or spawning activity for the three other species of Bregmaceros. The smallest larvae of Bregmaceros Type A often occurred at stations depths < 100 m and some spawning apparently occurred on the shelf and slope in the eastern Gulf. The two remaining species, B. atlanticus and B. macclellandi, are oceanic species whose larvae usually occurred at stations > 200 m deep; these species presumably spawn in oceanic areas.

Scombrids, though not among the 20 most common families, were abundant. Because of their economic importance, knowledge of their spawning areas and seasons is important. Most spawning by scombrids in the eastern Gulf is in summer. Catches of Scomberomorus cavalla were not significant and this economically important species does not appear to spawn much in the eastern Gulf. Catches of S. maculatus larvae were larger and distributed along the entire Florida Gulf coast, but the eastern Gulf does not appear to be a major spawning area for this species. Finucane et al. (1978) found larvae of S. cavalla to be common off the Texas coast and S. maculatus larvae less common, but possibly undersampled, because their station pattern did not include nearshore stations. A survey of the northeastern Gulf, off the Florida panhandle to the west of our survey stations, collected numerous S. cavalla and S. maculatus larvae, indicating that that area was important as a spawning area for these species (Dwinell and Futch, 1973). Small catches of Scomber japonicus were made mostly in winter months over deep shelf and slope waters. Finucane et al. (1978) also recorded larvae of this species in winter collections off the Texas coast as did Powles and Stender (1976), who found it to be common in the South Atlantic Bight.

Common scombrid larvae were Euthynnus alletteratus, Auxis sp., Thunnus atlanticus and T. thynnus. Thunnus thynnus occurred only on May cruises, when it was abundant at > 100 m deep stations, indicating significant spawning in the offshore part of our survey area. Larvae of T. thynnus also were abundant in offshore waters near the Campeche Bank in the western Gulf (Juarez, 1975) during spring. The remaining three species were collected in spring and especially summer, when larvae were nearly equally abundant. Spawning by E. alletteratus apparently is mostly in the 30-100 m depth zone, although significant spawning may take place over greater depths. Some larvae of Auxis sp. were collected in all seasons but there was a clear summer peak in abundance that indicated a maximum in spawning activity during summer.

Auxis sp. larvae usually were collected at depths > 50 m. Most spawning may take place between the 50 and 150 m isobaths because the majority of larval occurrences were at stations in that depth range. Thunnus atlanticus larvae occurred in spring and summer, mostly at stations between the 50 and 200 m isobaths, where spawning must occur. Peak spawning apparently takes place in summer. Finucane et al. (1978) also recorded E. alletteratus, Auxis sp. and T. atlanticus in spring-summer from stations off the Texas coast.

Few conclusions can be made from our study concerning seasonality of spawning by midwater fishes which we collected at our offshore stations and occasionally at shallower depths. There were spring-summer peaks in larval abundances for some myctophids and gonostomatids but all of the common species in these families occurred in all seasons. Our survey area only encompassed a fringe of the spawning range for these fishes in the Gulf of Mexico. Myctophid larvae dominated our catches at stations > 100 m deep, but this dominance possibly would have been even better demonstrated if more offshore stations had been included in the survey. If that type of survey had been carried out, spawning seasonality could have been determined for some of the midwater fishes.

We were successful in estimating biomasses of only a few species. The two prerequisites necessary to obtain such estimates from ichthyoplankton abundances often could not be met when we analyzed our Gulf collections. Eggs or smaller larvae usually were unidentified or unavailable and we seldom had estimates of fecundity to use in the estimating procedure. Multiple spawning, over most of the year, is characteristic of many fishes in the subtropics and adds to the difficulty of estimating fecundity. The number of spawnings may vary annually in response to environmental factors that affect the condition of adults in the stock. Another factor to be considered in estimating biomasses from ichthyoplankton abundances is the open-ended distribution of some species, particularly offshore spawners. When only a part of the ichthyoplankton is available for sampling, only a partial estimate of biomass is possible. If the adult population changes its distribution during the course of the spawning season and the proportion of adults in the survey area changes, then inaccurate biomass estimates will be made. Because of this problem it is nearly impossible to obtain good estimates of midwater fish biomass, based on survey areas in which only a part of the population is sampled. The great fluctuations in annual catches of some larvae, such as Maurollicus muelleri and Bregmaceros Type A, in our survey indicate that there may be important changes in annual larval production which possibly reflects great differences in adult biomasses or distributions.

Despite difficulties in determining biomasses, some general conclusions can be made from the few estimates that were made. The largest biomasses apparently are of pelagic fishes in the eastern Gulf. Based on our biomass estimates and relative larval abundances, only some clupeid species and a single carangid, Decapterus punctatus, appear to have biomasses in the 100,000-500,000 tonnes range. The small bothid flounder, Syacium papillosum, which is the most abundant

fish taken by demersal trawling in the eastern Gulf (Topp and Hoff, 1972; Alexander *et al.*, 1977) may have a biomass of approximately 100,000 tonnes, based on our larval production estimates. Other common bothids are less abundant and presumably have lower biomasses. Very high catches of goby larvae and larvae of the small serranid, Diplectrum formosum, indicate that these relatively small demersal fishes may have large biomasses in the eastern Gulf, but relative fecundities (i.e., ova produced per gram of somatic tissue) probably are high and their biomasses lower than larval abundances would indicate. Based on relative larval abundances, biomasses of gerreids, sparids, pomadasydids and some other demersal fishes may be substantial in the eastern Gulf but they are unlikely to be as high as those of some pelagic fishes. Our survey did not adequately cover the nearshore spawning areas of many sciaenid fishes, but abundances of their larvae were never high enough to indicate that large biomasses were present in the eastern Gulf. A tentative conclusion, based on our biomass estimates of some abundant species and observed relative larval abundances of other fishes, is that the biomass of pelagic fishes (exclusive of midwater species) lies between 1.5 and 3 million tonnes in the eastern Gulf, while demersal species probably have an aggregate biomass of less than 1 million tonnes.

Apparently, there were no significant, annual or seasonal changes in ichthyoplankton diversity in the eastern Gulf of Mexico. From the 94 species taxocene, a mean of 49.8 species per cruise was observed. The kinds of larvae that were present changed seasonally but the distribution of individuals among species apparently was relatively constant from month to month. Changes in species were most apparent at nearshore stations where seasonal spawning patterns were best expressed. The great abundances of clupeid larvae in spring and summer at coastal sampling sites caused diversity in those seasons to be lower than might be expected if only the number of species was considered.

No overall difference in diversity was detected between the northern and southern sectors of the sampling areas when all cruises were considered, but on individual cruises the differences usually were significant. In some cruises diversity was highest in the north and in other cruises in the south. The number of taxocene species usually was greater in the southern half of the survey area but dominance of the community by abundant species (often clupeids) sometimes made the diversity estimates for that sector lower than might have been expected.

There were clear differences in diversity between onshore and offshore zones of the survey area. Ichthyoplankton diversity is highest in the offshore zone. The evenness component (J) of diversity, which gives an estimate that is independent of the number of species present, was always highest at > 50 m depths. Nearshore collections often were dominated by single species of clupeids or by a few species of larvae, while at deeper stations the number of species increased and usually no single species dominated the catch. The family Myctophidae did dominate offshore catches, just as Clupeidae often dominated nearshore collections. But, the Myctophidae is a speciose family and

the presence of several species in this family contributed to an increase in ichthyoplankton diversity at offshore stations. In contrast, the Clupeidae has relatively few species in the eastern Gulf and, when present in large numbers, they caused ichthyoplankton diversity to be low.

It is not clear how identification and inclusion of larval Gobiidae in diversity analyses would affect estimates of diversity at onshore and offshore stations. Gobiids are abundant, apparently speciose, and they occur commonly at nearshore and offshore stations. It is clear that at the family level the Clupeidae and Gobiidae contributed 35.6% of all larvae collected and that those families dominated eastern Gulf ichthyoplankton. Without knowing how many or what species of gobies are present, and their distribution by depth zone, it is impossible to know how diversity estimates in the onshore vs offshore zone might change with inclusion of these larvae in the analyses.

The attempt to correlate abundances of larval fishes with some environmental variables in a simple linear correlation analysis was unsuccessful. There were several possible reasons. Surface temperatures and salinities were used in the analyses. These variables may have been poor correlates of larval fish abundance if the larvae were actually collected at depths where temperatures and salinities differed significantly from those at the surface. Oblique tows of the plankton sampler did not provide us with knowledge of the depth distribution of larvae, but gave an integrated abundance estimate for the entire water column that was sampled by the gear. Several species of oceanic fish larvae had significant negative correlations with surface salinities, which probably were spurious. They resulted from apparent positive associations of larvae with the low surface salinities in the eastern Gulf of Mexico during summer 1973 as record Mississippi River flood runoff "floated" in a 15 m thick lens across the west Florida shelf and slope waters. It is probable that larvae which are usually associated with high salinity water actually were sampled from below the 15 m lens in waters of relatively high salinity, but the oblique tow sampling method could not detect their actual depth distribution. The lack of significant correlations between larvae and zooplankton volumes (Tables 55-77) perhaps is not surprising since specific kinds of plankton that might serve as prey for larvae were not correlated with the larval abundances. Houde and Chitty (1976) found evidence that total fish egg and larvae abundances usually were positively correlated with zooplankton volumes from collections used in this study. Because plankton-eating adult fishes are important spawners in the eastern Gulf, it is possible that positive correlations of eggs or larvae with zooplankton volumes are related to presence of spawning and feeding adults in rich feeding areas and bear no relation to larval food habits or needs.

By examining cumulative frequency distributions of station occurrences for larvae in relation to surface temperatures, surface salinities and station depths it was possible to delineate the most favorable conditions for occurrence of many larvae. Depth zones of

maximum occurrence and ranges of favored surface temperatures were determined from the frequency distributions of occurrences. Most eastern Gulf species occurred over wide (10-15°C) ranges of surface temperatures, but favored temperatures were usually in a narrower range (5-8°C). The relationship of larval occurrences to station depth varied among species, with some species, like Decapterus punctatus, occurring at all depths in the survey area and others, such as Chloroscombrus chrysurus, being restricted to narrow depth zones. Relationships between larval occurrences and surface salinities were not clear, in part due to the unusual, summer 1973 low salinity conditions, but mostly due to the low range of salinities usually present over shelf waters of the eastern Gulf.

The Loop Current has a strong influence on circulation in the eastern Gulf of Mexico (Maul, 1977; Molinari et al., 1977). Intrusions of the Loop onto the shelf are common and eddies that break away from the Loop are sometimes entrained into the shelf circulation. The presence of the Loop could have significant effects on spawning by fishes, either by altering distribution and spawning behavior of adults or by affecting the potential for survival of larvae. The entrainment of larvae normally associated with oceanic conditions into shelf waters could be a consequence of Loop intrusions. It also is possible that Loop Current transport can act as a recruitment mechanism for tropical fishes sometimes found in the northeastern Gulf of Mexico. Our analysis of occurrences of 14 species of larval fishes that normally occurred at stations > 50 m deep provided evidence that some of these species were more frequently associated with water derived from the Loop Current when they occurred at depths < 100 m than would be expected by chance alone. There was a strong indication of entrainment in Loop Current water for six of the species and a positive association for 10 of the 14 species. Two of the species that showed no Loop Current association probably are not species normally found in Loop Current water. When they were not considered, 10 of the 12 remaining species had positive associations with Loop Current water when it was present on the shelf.

Another approach to determine effects of the Loop Current on ichthyoplankton and perhaps to use the ichthyoplankton as a source of indicator organisms that provide evidence of Loop Current influence is to undertake an analysis of fish larvae at the community level. Rather than examining single species, whose abundances are subject to a relatively large amount of sampling variability, related kinds of larvae could be classified into assemblages. Through the use of clustering analyses or other classification methods, the influence of Loop Current circulation on the structure of ichthyoplankton communities could be determined. The classification of larvae into closely related groups or assemblages in the eastern Gulf would have wider applicability than only to investigate Loop Current influences. Using this approach, conditions associated with spawning by functionally related kinds of fishes could be clearly delineated in the eastern Gulf of Mexico. Also, the potential impacts of an altered environment on ichthyoplankton could be investigated at the community level, which might be more valuable than trying to evaluate such impacts on a species by species basis.

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Table 1. Summary information for 17 ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974.

Cruise	Dates	Number of stations	Area represented by the cruise ($\text{m}^2 \times 10^9$)	Number collected	
				Eggs	Larvae
GE 7101 ¹	1-8 Feb 1971	20	25.79	47,753	8,615
8C 7113- TI 7114 ¹	7-18 May 1971	123	120.48	27,385	19,229
GE 7117	26 Jun - 4 Jul 1971	27	101.10	3,594	2,149
8C 7120- TI 7121	7-25 Aug 1971	146	189.43	21,567	18,037
TI 7131- 8B 7132	7-16 Nov 1971	64	72.99	4,225	3,979
8B 7201- GE 7202	1-11 Feb 1972	30	148.85	5,068	2,290
GE 7208	1-10 May 1972	30	124.88	15,627	7,450
GE 7210	12-18 Jun 1972	13	48.43	6,165	2,239
IS 7205	9-17 Sept 1972	34	104.59	9,245	10,872
IS 7209	8-16 Nov 1972	50	149.80	7,487	4,511
IS 7303	19-27 Jan 1973	51	149.80	12,378	4,642

Table 1. Continued.

Cruise	Dates	Number of stations	Area represented by the cruise (m ² x 10 ⁹)	Number collected	
				Eggs	Larvae
IS 7308	9-17 May 1973	49	151.42	26,103	13,652
IS 7311	27 Jun - 6 Jul 1973	51	156.50	14,523	10,881
IS 7313	3-13 Aug 1973	50	153.18	24,798	10,419
IS 7320	6-14 Nov 1973	51	153.89	5,452	4,999
CL 7405	28 Feb - 9 Mar 1974	36	52.00	16,020	2,216
CL 7412	1-9 May 1974	44	91.33	57,230	16,854

¹ On cruise GE 7101 and TI 7114 an ICITA, one-meter plankton net was used. On all other cruises a 61-cm bongo net sampler was used.

Ship Codes: GE = R/V GERDA; 8C = R/V DAN BRAMAN; TI = R/V TURSIOPS; 8B = R/V BELLOWS; IS = R/V COLUMBUS ISELIN; CL = R/V CALANUS

Table 2. Ninety-one families of fish larvae collected on 17 cruises to the eastern Gulf of Mexico, 1971-1974. Numbers of individuals, percent of total larvae collected and ranked observed number.

Family	Number of individuals	Percent of larvae	Family rank
Elopidae	6	0.004	72
Clupeidae	29,290	20.478	1
Engraulidae	2,880	2.014	12
Argentinidae	45	0.031	48
Bathylagidae	11	0.008	68.5
Gonostomatidae	2,486	1.738	14
Sternoptychidae	166	0.116	37
Stomiatidae	16	0.011	67
Chauliodontidae	24	0.017	62
Astronesthidae	1	0.001	87.5
Melanostomiatidae	30	0.021	58.5
Synodontidae	4,294	3.002	7
Aulopidae	5	0.003	74
Scopelarchidae	28	0.020	60
Evermannellidae	6	0.004	72
Paralepididae	292	0.204	33
Myctophidae	7,223	5.050	4
Ipnopidae	1	0.001	87.5
Chlorophthalmidae	11	0.008	68.5
Scopelosauridae	2	0.001	81
Giganturidae	1	0.001	87.5
Muraenidae	130	0.091	41
Nettastomidae	90	0.063	43
Congridae	146	0.102	39
Ophichthidae	208	0.145	36
Dysommidae	2	0.001	81
Belonidae	6	0.004	72
Hemiramphidae	45	0.031	48
Exocoetidae	72	0.050	45

Table 2. Continued.

Family	Number of individuals	Percent of larvae	Family rank
Gadidae	54	0.038	46
Bregmacerotidae	3,818	2.669	9
Macrouridae	4	0.003	75
Fistulariidae	1	0.001	87.5
Macrorhamphosidae	3	0.002	77
Syngnathidae	247	0.173	35
Melamphaeidae	38	0.027	53
Holocentridae	34	0.024	55.5
Caproidae	42	0.029	50
Mugilidae	252	0.176	34
Atherinidae	45	0.031	48
Sphyraenidae	34	0.024	55.5
Serranidae	6,949	4.858	5
Priacanthidae	154	0.108	38
Apogonidae	2,296	1.605	15
Branchiostegidae	26	0.018	61
Echeneidae	3	0.002	77
Rachycentridae	2	0.001	81
Carangidae	5,564	3.890	6
Bramidae	30	0.021	58.5
Coryphaenidae	17	0.012	65.5
Lutjanidae	1,753	1.226	19
Acanthuridae	17	0.012	65.5
Gerreidae	1,458	1.019	22
Pomadasyidae	2,933	2.051	11
Sciaenidae	415	0.290	30
Sparidae	1,683	1.177	20
Mullidae	302	0.211	32
Kyphosidae	18	0.013	64

Table 2. Continued.

Family	Number of individuals	Percent of larvae	Family rank
Ephippidae	1	0.001	87.5
Chaetodontidae	32	0.022	57
Pomacentridae	445	0.311	28
Labridae	3,230	2.258	10
Scaridae	569	0.398	26
Opistognathidae	417	0.292	29
Uranoscopidae	1	0.001	87.5
Blenniidae	1,996	1.395	18
Clinidae	502	0.351	27
Ophidiidae	4,151	2.902	8
Carapidae	305	0.213	31
Callionymidae	1,605	1.122	21
Scombridae	1,266	0.885	23
Gempylidae	79	0.055	44
Trichiuridae	10	0.007	70
Istiophoridae	2	0.001	81
Stromateidae	37	0.026	54
Nomeidae	135	0.094	40
Arionmmidae	95	0.066	42
Gobiidae	21,621	15.116	2
Microdesmidae	39	0.027	52
Scorpaenidae	2,066	1.444	17
Triglidae	2,230	1.559	16
Dactylopteridae	1	0.001	87.5
Bothidae	9,165	6.408	3
Pleuronectidae	1	0.001	87.5
Soleidae	41	0.028	51
Cynoglossidae	815	0.570	25
Balistidae	2,808	1.963	13
Ostraciidae	3	0.002	77

Table 2. Continued.

Family	Number of individuals	Percent of larvae	Family rank
Tetraodontidae	1,139	0.796	24
Diodontidae	2	0.001	81
Gobiesocidae	23	0.016	63
Unidentified at Family level	12,493	8.734	
Total larvae	143,034	100.000	

Table 3. Numbers of individuals in the 10 most frequently observed families collected in each of 17 cruises to the eastern Gulf of Mexico, 1971-1974.

Cruise	Family	Number of larvae	Cruise	Family	Number of larvae
GE 7101	Clupeidae	1,713	8C 7113- TI 7114	Gobiidae	2,976
	Serranidae	823		Myctophidae	2,129
	Gobiidae	784		Serranidae	1,669
	Pomadasyidae	448		Clupeidae	1,613
	Bothidae	350		Bothidae	1,356
	Sparidae	334		Ophidiidae	1,153
	Labridae	282		Pomadasyidae	950
	Carangidae	276		Synodontidae	875
	Ophidiidae	206		Engraulidae	811
	Tetraodontidae	186		Carangidae	608
GE 7117	Gobiidae	312	8C 7120- TI 7121	Gobiidae	2,799
	Bothidae	287		Bothidae	2,184
	Synodontidae	246		Clupeidae	1,561
	Clupeidae	190		Myctophidae	1,352
	Bregmacerotidae	113		Synodontidae	1,127
	Myctophidae	91		Labridae	846
	Ophidiidae	77		Carangidae	781
	Scorpaenidae	61		Bregmacerotidae	624
	Scombridae	53		Scombridae	582
	Gonostomatidae	53		Engraulidae	503

Table 3. Continued.

Cruise	Family	Number of larvae	Cruise	Family	Number of larvae
TI 7131	Gobiidae	570	8B 7201-	Clupeidae	270
8B 7132	Bregmacerotidae	474	GE 7202	Gobiidae	249
	Bothidae	422		Bothidae	237
	Synodontidae	289		Sparidae	177
	Triglidae	261		Synodontidae	137
	Myctophidae	220		Serranidae	97
	Serranidae	183		Myctophidae	91
	Carangidae	153		Bregmacerotidae	82
	Clupeidae	129		Carangidae	69
	Ophidiidae	122		Pomadasyidae	48
GE 7208	Myctophidae	908	GE 7210	Clupeidae	1,230
	Clupeidae	854		Gobiidae	204
	Gobiidae	657		Carangidae	118
	Serranidae	510		Balistidae	58
	Carangidae	373		Serranidae	57
	Balistidae	321		Ophidiidae	47
	Bothidae	274		Lutjanidae	46
	Synodontidae	233		Bothidae	40
	Engraulidae	220		Apogonidae	32
	Ophidiidae	214		Callionymidae	31

Table 3. Continued.

Cruise	Family	Number of larvae	Cruise	Family	Number of larvae
IS 7205	Clupeidae	3,850	IS 7209	Gobiidae	1,292
	Gobiidae	1,631		Bothidae	541
	Carangidae	720		Bregmacerotidae	399
	Bothidae	619		Ophidiidae	258
	Serranidae	562		Triglidae	161
	Ophidiidae	413		Myctophidae	151
	Lutjanidae	267		Carangidae	146
	Callionymidae	264		Scorpaenidae	115
	Gerreidae	239		Balistidae	99
	Bregmacerotidae	238		Gonostomatidae	94
IS 7303	Bothidae	617	IS 7308	Clupeidae	3,589
	Gobiidae	603		Gobiidae	2,539
	Myctophidae	396		Serranidae	889
	Clupeidae	308		Carangidae	579
	Serranidae	292		Bothidae	552
	Bregmacerotidae	260		Balistidae	401
	Sparidae	249		Pomadasyidae	391
	Synodontidae	225		Myctophidae	387
	Gonostomatidae	163		Blenniidae	316
	Carangidae	150		Ophidiidae	311

Table 3. Continued.

Cruise	Family	Number of larvae	Cruise	Family	Number of larvae
IS 7311	Clupeidae	4,218	IS 7313	Clupeidae	2,350
	Gobiidae	1,291		Gobiidae	1,889
	Myctophidae	820		Bothidae	524
	Gonostomatidae	521		Carangidae	480
	Bothidae	322		Gonostomatidae	383
	Carangidae	271		Lutjanidae	346
	Lutjanidae	253		Engraulidae	322
	Callionymidae	251		Myctophidae	281
	Serranidae	220		Apogonidae	270
	Labridae	205		Callionymidae	250
IS 7320	Gobiidae	919	CL 7405	Pomadasyidae	347
	Bothidae	579		Gobiidae	249
	Bregmacerotidae	462		Blenniidae	245
	Ophidiidae	276		Sparidae	205
	Triglidae	244		Engraulidae	211
	Carangidae	230		Serranidae	155
	Synodontidae	219		Clupeidae	152
	Myctophidae	203		Triglidae	93
	Scorpaenidae	165		Ophidiidae	92
	Callionymidae	102		Sciaenidae	56

Table 3. Continued.

Cruise	Family	Number of larvae	Cruise	Family	Number of larvae
CL 7412	Clupeidae	7,189			
	Gobiidae	3,439			
	Carangidae	588			
	Balistidae	575			
	Serranidae	564			
	Ophidiidae	372			
	Labridae	333			
	Apogonidae	325			
	Pomadasyidae	305			
	Bothidae	215			

Table 4. Numbers of genera and species identified and the numbers of larvae identified to species in the 20 most frequently observed families from 17 ichthyoplankton cruises to the eastern Gulf of Mexico.

Rank	Family	Number of specimens	Number of genera identified	Number of species identified	Identified to species	
					Number	Percent
1	Clupeidae	29,290	5	4	28,561	97.51
2	Gobiidae	21,621	0	0	0	0
3	Bothidae	9,165	9	11	8,808	97.16
4	Myctophidae	7,223	16	25	1,980	27.41
5	Serranidae	6,949	12	16	5,168	74.37
6	Carangidae	5,564	10	8	5,439	97.75
7	Synodontidae	4,294	2	2	10	0.23
8	Ophidiidae	4,151	0	0	0	0
9	Bregmacerotidae	3,784	1	4	3,762	99.44
10	Labridae	3,230	0	0	0	0
11	Pomadasyidae	2,933	1	1	771	26.29
12	Engraulidae	2,880	0	0	0	0
13	Balistidae	2,808	0	0	0	0
14	Gonostomatidae	2,486	11	12	1,634	65.73
15	Apogonidae	2,296	0	0	0	0
16	Triglidae	2,230	0	0	0	0
17	Scorpaenidae	2,066	0	0	0	0

Table 4. Continued.

Rank	Family	Number of specimens	Number of genera identified	Number of species identified	<u>Identified to species</u>	
					Number	Percent
18	Blenniidae	1,996	0	0	0	0
19	Lutjanidae	1,753	4	3	81	4.62
20	Sparidae	1,683	4	4	778	46.23
	TOTALS	118,401	75	90	56,992	

Table 5. Cruise GE 7101. Numbers of larvae, estimated total abundance in the area represented by the cruise ($25.79 \times 10^9 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeiformes	1	2.0083	0.779
Clupeidae	30	0.8726	0.338
Etrumeus teres	310	26.0932	10.118
Sardinella anchovia	1,373	47.0526	18.245
Engraulidae	20	0.58201	0.226
Argentinidae			
Microstoma spp.	1	0.0220	0.009
Gonostomatidae	1	0.0125	0.005
Cyclothone spp.	12	14.1682	5.494
Maurolicus muelleri	6	12.0498	4.672
Vinciguerrria nimbaria	5	4.1205	1.598
Sternoptychidae			
Argyropelecus spp.	1	2.0083	0.779
Stomiatidae			
Stomias spp.	2	0.1174	0.046
Chauliodontidae			
Chauliodus spp.	3	2.0333	0.788

Table 5. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Melanostomiatidae	4	8.0332	3.115
Synodontidae	132	9.7065	3.764
Scopelarchidae	1	0.0125	0.005
Paralepididae	4	8.0332	3.115
Myctophidae	28	52.2975	20.278
Diaphus spp.	76	85.7173	33.237
Lampadena luminosa	1	0.0376	0.015
Lampanyctus spp.	3	4.0673	1.577
Myctophum nitidulum	5	2.1044	0.816
Ceratoscopelus warmingi	2	2.0557	0.797
Hygophum spp.	1	0.0125	0.005
Centrobranchus nigroocellatus	1	0.0587	0.023
Lepidophanes spp.	7	4.2277	1.639
Notoscopelus caudispinosus	24	40.2158	15.594
Notoscopelus resplendens	1	0.0409	0.016
Benthoosema suborbitale	1	2.0083	0.779
Ipnopidae	1	0.0220	0.009

Table 5. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Chlorophthalmidae			
Chlorophthalmus agassizi	2	0.0982	0.038
Notosudidae			
Scopelosaurus spp.	1	0.0125	0.005
Anguilliformes	3	0.1298	0.050
Nettastomidae	2	2.0208	0.784
Hoplunnis macrurus	1	0.0125	0.005
Ophichthidae	1	0.0125	0.005
Ophichthus spp.	1	0.0224	0.009
Myrophis punctatus	1	0.0326	0.013
Hemiramphidae			
Hyporhamphus unifasciatus	1	0.0237	0.009
Hemiramphus balao	1	0.0220	0.009
Exocoetidae	5	0.0834	0.032
Danichthys rondeletti	1	0.0220	0.009
Prognichthys gibbifrons	1	0.0220	0.009
Gadidae			
Urophycis spp.	18	0.6144	0.238

Table 5. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Bregmacerotidae			
Bregmaceros atlanticus	5	0.0624	0.024
Bregmaceros Type A	12	2.3331	0.905
Bregmaceros Type B	100	9.5140	3.689
Bregmaceros Macclellandi	2	0.0250	0.010
Macrorhamphosidae			
Macrorhamphosus scolopax	2	0.0982	0.038
Syngnathidae			
Hippocampus erectus	5	0.0664	0.026
Syngnathus spp.	4	0.0436	0.017
Syngnathus dunckeri	1	0.0125	0.005
Syngnathus elucens	8	0.1571	0.061
Syngnathus springeri	7	0.1836	0.071
Syngnathus louisianae	2	0.0353	0.014
Syngnathus scovelli	3	0.0394	0.015
Holocentridae	2	0.0534	0.021
Caproidae			
Antigonia spp.	6	4.2127	1.634

Table 5. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Mugilidae			
Mugil spp.	89	3.8093	1.477
Sphyraenidae			
Sphyraena borealis	2	0.0345	0.013
Serranidae	333	22.1493	8.588
Diplectrum formosum	384	11.4070	4.423
Epinephelus spp.	15	0.7377	0.286
Serranus spp.	19	0.8866	0.344
Hemanthias vivanus	15	0.3020	0.117
Hemanthias leptus	1	0.0505	0.020
Pronotogrammus aurorubens	10	0.2577	0.100
Anthias spp.	1	0.0587	0.022
Anthias Type 1	25	0.9114	0.353
Anthias Type 3	18	0.2880	0.112
Rypticus spp.	2	0.0630	0.024
Priacanthidae	2	0.0632	0.024
Priacanthus arenatus	1	0.0125	0.005
Apogonidae	97	3.5554	1.379

Table 5. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Branchiostegidae	1	0.0376	0.015
Carangidae			
Caranx spp.	3	0.1169	0.045
Decapterus punctatus	200	10.1797	3.947
Seriola spp.	1	0.0475	0.018
Trachurus lathami	72	8.9558	3.473
Bramidae	4	4.0416	1.567
Coryphaenidae			
Coryphaena hippurus	1	0.0475	0.018
Lutjanidae	1	0.0475	0.018
Pristipomoides aquilonaris	2	0.1174	0.046
Acanthuridae			
Acanthurus spp.	4	2.0838	0.808
Gerreidae	18	0.6048	0.235
Pomadasyidae	261	8.7895	3.408
Orthopristis chrysoptera	187	2.5179	0.976
Sciaenidae	5	0.0980	0.038

Table 5. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Sparidae	272	9.0211	3.498
Lagodon rhomboides	59	1.6666	0.646
Pagrus pagrus	3	0.1760	0.068
Mullidae	82	6.7759	2.627
Kyphosidae			
Kyphosus spp.	4	2.1506	0.834
Chaetodontidae	7	4.2014	1.629
Pomacentridae	20	0.7443	0.289
Labridae	282	19.2439	7.462
Scaridae	22	4.6638	1.808
Opistognathidae	43	1.6122	0.625
Blenniidae	183	6.3827	2.475
Clinidae	38	0.9346	0.362
Ophidiidae	206	7.5587	2.931
Carapidae			
Echiodon sp.	9	2.1846	0.847
Callionymidae	61	5.1757	2.007

Table 5. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Scombridae	1	0.0505	0.020
Auxis sp.	1	0.0409	0.016
Scomber japonicus	4	0.2024	0.079
Gempylidae	1	0.0587	0.023
Nesiarchus nasutus	1	2.0083	0.779
Trichiuridae			
Diplospinus multistriatus	1	2.0083	0.779
Nomeidae			
Psenes spp.	1	2.0083	0.779
Psenes pellucidus	5	10.0415	3.894
Ariommidae			
Ariomma spp.	7	0.3322	0.129
Gobiidae	784	36.1857	14.031
Scorpaenidae	123	5.3540	2.076
Triglidae	163	5.9331	2.301
Bothidae	104	3.0246	1.173
Citharichthys spp.	1	0.0125	0.005
Citharichthys cornutus	12	0.3194	0.124

Table 5. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
<i>Citharichthys macrops</i>	119	2.6532	1.029
<i>Citharichthys spilopterus</i>	1	0.0125	0.005
<i>Citharichthys gymnorhinus</i>	3	0.1219	0.047
<i>Cyclopsetta fimbriata</i>	1	0.0474	0.018
<i>Etropus rimosus</i>	120	5.6753	2.200
<i>Syacium papillosum</i>	34	1.3099	0.508
<i>Monolene sessilicauda</i>	3	0.0659	0.026
<i>Bothus robinsi</i>	66	8.1944	3.177
<i>Paralichthys</i> spp.	3	0.8998	0.349
Soleidae	1	0.0125	0.005
<i>Gymnachirus melas</i>	1	0.0409	0.016
Cynoglossidae			
<i>Symphurus</i> spp.	26	1.0607	0.411
Balistidae	120	4.7733	1.851
Tetraodontidae	186	6.1626	2.390
Lophiiformes	2	0.1014	0.039

Table 5. Continued.

Taxa		Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Unidentified Larvae		1,396	187.2175	72.593
Total Larvae		8,615	789.7316	306.216
NUMBER OF FAMILIES:	66			
NUMBER OF SPECIES:	60			

Table 6. Cruise 8C 7113-TI 7114. Numbers of larvae, estimated total abundance in the area represented by the cruises ($120.48 \times 10^9 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeidae	48	12.6835	1.0537
Etrumeus teres	102	41.2308	3.422
Harengula jaguana	243	81.0659	6.729
Opisthonema oglinum	1,213	334.6204	27.774
Sardinella anchovia	7	4.4498	0.369
Engraulidae	811	297.765	24.715
Argentinidae	1	0.3698	0.031
Argentina spp.	8	2.7864	0.231
Nansenia spp.	1	0.2770	0.023
Bathylagidae			
Bathylagus spp.	2	0.7278	0.060
Gonostomatidae	8	4.0979	0.340
Cyclothone spp.	36	9.5734	0.795
Gonostoma elongatum	1	0.3698	0.031
Maurolicus muelleri	94	36.0159	2.989
Vinciguerrria spp.	2	0.5509	0.046
Vinciguerrria nimbaria	33	9.0991	0.755

Table 6. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Vinciguerria poweriae</i>	38	16.8936	1.402
<i>Vinciguerria attenuata</i>	19	6.8395	0.489
Chauliodontidae			
<i>Chauliodus</i> spp.	1	0.1484	0.012
Synodontidae	873	264.4032	21.946
<i>Saurida brasiliensis</i>	2	0.5075	0.042
Aulopidae			
<i>Aulopus nanai</i>	1	0.2770	0.023
Paralepididae	20	6.9775	0.579
Myctophidae	2	0.5314	0.044
<i>Diaphus</i> spp.	1,078	387.3126	32.148
<i>Notolychnus valdiviae</i>	17	7.5212	0.624
<i>Lampanyctus alatus</i>	10	5.1554	0.428
<i>Lampanyctus ater</i>	4	1.2386	0.103
<i>Lampanyctus cuprarius</i>	2	0.8599	0.071
<i>Myctophum nitidulum</i>	106	46.3611	3.848
<i>Myctophum selenops</i>	2	0.5483	0.046
<i>Ceratoscopelus warmingi</i>	50	14.9784	1.243

Table 6. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Hygophum spp.	770	247.461	20.540
Hygophum reinhardtii	6	1.6585	0.138
Centrobranchus nigrocellatus	2	1.0007	0.083
Gonichthys coccoi	2	0.6600	0.055
Lepidophanes spp.	20	6.0847	0.505
Lepidophanes guntheri	1	0.2770	0.023
Notoscopelus resplendens	1	0.2770	0.101
Benthosema suborbitale	23	10.7820	0.895
Diogenichthys atlanticus	24	7.2747	0.604
Anguilliformes	8	1.6260	0.135
Muraenidae	8	1.3310	0.110
Gymnothorax nigromarginatus	10	2.9636	0.246
Anarchias yoshiae	1	0.3698	0.031
Nettastomidae	4	0.8686	0.072
Hoplunnis diomedianus	5	2.3668	0.197
Congridae	2	0.3840	0.032
Hildebrandia gracilior	2	0.5483	0.046

Table 6. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Ophichthidae	7	4.5158	0.375
Ophichthus spp.	5	1.2135	0.101
Belonidae	1	0.4176	0.035
Hemiramphidae			
Hyporhamphus unifasciatus	3	1.2528	0.104
Exocoetidae	1	0.2541	0.021
Cypselurus spp.	2	0.2751	0.023
Prognichthys gibbifrons	4	0.7181	0.060
Bregmacerotidae			
Bregmaceros spp.	19	5.2150	0.433
Bregmaceros atlanticus	5	1.8175	0.151
Bregmaceros Type A	137	39.7548	3.300
Bregmaceros Type B	198	118.6699	9.850
Bregmaceros macclellandi	2	1.9119	0.159
Macrouridae	1	0.2770	0.023
Syngnathidae			
Hippocampus erectus	3	0.6201	0.052
Syngnathus spp.	1	0.2626	0.022

Table 6. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Syngnathus elucens</i>	4	0.7202	0.060
<i>Syngnathus springeri</i>	3	0.8895	0.074
<i>Syngnathus louisianae</i>	2	0.8352	0.069
Melamphaeidae			
<i>Melamphaes</i> spp.	2	0.9314	0.077
Holocentridae	4	0.7334	0.061
Caproidae			
<i>Antigonia</i> spp.	4	1.0063	0.084
Mugilidae			
<i>Mugil</i> spp.	28	5.8649	0.487
Sphyraenidae			
<i>Sphyraena borealis</i>	5	1.2595	0.104
Serranidae	158	42.9964	3.569
<i>Diplectrum</i> spp.	7	1.4905	0.124
<i>Diplectrum formosum</i>	1,170	358.4440	29.751
<i>Epinephelus</i> spp.	31	9.4440	0.524
<i>Epinephelus morio</i>	1	0.2744	0.023
<i>Serranus</i> spp.	27	14.3285	1.189

Table 6. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Centropristis striata</i>	93	27.0710	2.247
<i>Hemanthias vivanus</i>	113	38.8770	3.227
<i>Pronotogrammus aurorubens</i>	29	6.6632	0.553
<i>Serraniculus pumilio</i>	35	11.9422	0.991
<i>Liopropoma</i> Type 1	1	0.3447	0.029
<i>Anthias</i> Type 1	2	0.8023	0.067
<i>Rypticus</i> spp.	2	0.4940	0.041
Priacanthidae	1	0.2624	0.022
Apogonidae	226	61.7724	5.127
Branchiostegidae			
<i>Caulocaticus</i> spp.	3	0.6828	0.057
Carangidae			
<i>Chloroscombrus chrysurus</i>	3	1.2528	0.104
<i>Decapterus punctatus</i>	587	160.8033	13.347
<i>Seriola</i> spp.	3	2.0870	0.173
<i>Trachinotus</i> spp.	1	0.4176	0.035
<i>Trachurus lathami</i>	14	2.8548	0.237
Bramidae	18	2.9308	0.243

Table 6. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Coryphaenidae			
Coryphaena spp.	1	0.3447	0.029
Coryphaena equiselus	2	0.3072	0.026
Coryphaena hippurus	1	0.1358	0.011
Lutjanidae	24	6.1352	0.509
Pristipomoides aquilonaris	1	0.2055	0.017
Rhomboplites aurorubens	1	0.2707	0.023
Gerreidae	45	12.7346	1.057
Pomadasyidae	483	164.1746	13.627
Orthopristis chrysoptera	149	34.8936	2.896
Sciaenidae	15	4.4984	0.373
Cynoscion nebulosus	6	1.3660	0.113
Leiostomus xanthurus	3	0.7670	0.064
Menticirrhus saxatilis	3	1.2986	0.108
Micropogon undulatus	1	0.2573	0.021
Sparidae	118	32.3933	2.689
Archosargus probatocephalus	272	78.6150	6.525
Mullidae	61	12.8767	1.069

Table 6. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Mulius auratus	8	2.0373	0.169
Chaetodontidae	1	0.1626	0.014
Pomacentridae	103	25.6636	2.130
Labridae	536	145.8586	12.107
Scaridae	13	3.3026	0.274
Opistognathidae	69	16.7087	1.387
Blenniidae	605	177.9146	14.711
Clinidae	74	25.4920	2.1160
Ophidiidae	1,153	324.8480	26.963
Carapidae			
Echiodon sp.	26	7.0988	0.589
Callionymidae	98	30.4623	2.528
Scombridae			
Auxis sp.	16	6.6579	0.553
Euthynnus alletteratus	3	1.0522	0.087
Katsuwonus pelamis	2	0.7395	0.061
Thunnus thynnus	3	0.8212	0.068

Table 6. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Scomber japonicus</i>	3	1.9763	0.164
<i>Scomberomorus maculatus</i>	1	0.3768	0.031
Gempylidae	2	0.8330	0.069
Trichiuridae			
<i>Diplospinus multistriatus</i>	2	0.2968	0.025
Ariommidae			
<i>Ariomma</i> spp.	7	3.2507	0.270
Gobiidae	2,194	551.3482	45.763
Microdesmidae			
<i>Microdesmus</i> spp.	13	4.1936	0.348
Scorpaenidae	305	94.0073	7.803
Triglidae	357	110.5747	9.178
Pleuronectiformes	21	6.2720	0.521
Bothidae	47	14.0822	1.170
<i>Citharichthys cornutus</i>	132	42.1605	3.499
<i>Citharichthys macrops</i>	83	26.2478	2.179
<i>Citharichthys gymnorhinus</i>	57	12.5806	1.044
<i>Cyclopsetta fimbriata</i>	5	0.6908	0.057

Table 6. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Etropus rimosus</i>	873	231.1126	19.183
<i>Syacium papillosum</i>	102	26.8168	2.226
<i>Monolene sessilicauda</i>	3	0.5531	0.046
<i>Bothus robinsi</i>	54	12.7494	1.058
Soleidae			
<i>Achirus lineatus</i>	1	0.2573	0.021
<i>Gymnachirus melas</i>	6	2.0093	0.167
Cynoglossidae			
<i>Symphurus</i> spp.	116	32.7088	2.715
Balistidae	312	84.2502	6.993
Tetraodontidae	218	59.0524	4.901
Gobiesocidae	12	2.4955	0.207
Lophiiformes	35	9.4919	0.788
Unidentified Larvae	1,149	335.3129	27.831
Total Larvae	19,229	5,747.5546	477.055
NUMBER OF FAMILIES:	63		
NUMBER OF SPECIES:	81		

Table 7. Cruise GE 7117. Numbers of larvae, estimated total abundance in the area represented by the cruise ($101.10 \times 10^9 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Elopidae			
Megalops atlantica	4	6.0953	0.603
Clupeidae	8	3.5505	0.351
Opisthonema oglinum	182	179.5309	17.758
Engraulidae	46	54.9602	5.436
Argentinidae			
Argentina spp.	3	6.6652	0.659
Gonostomatidae	5	20.4081	2.019
Cyclothone spp.	4	23.6607	2.340
Maurolicus muelleri	44	92.2480	9.124
Chauliodontidae			
Chauliodus spp.	1	1.7456	0.173
Synodontidae	246	284.4779	28.138
Myctophidae	2	3.5462	0.351
Diaphus spp.	80	88.3256	8.737
Lampanyctus alatus	1	1.7456	0.173
Myctophum nitidulum	3	5.0317	0.498

Table 7. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Ceratoscopelus warmingi</i>	3	8.7127	0.862
<i>Hygophum reinhardti</i>	2	5.8085	0.575
Anguilliformes	1	2.9042	0.288
Muraenidae	2	11.1045	1.098
<i>Gymnothorax nigromarginatus</i>	6	15.5674	1.540
Nettastomidae	2	2.8093	0.278
Congridae			
<i>Hildebrandia gracilior</i>	2	1.4986	0.148
Ophichthidae	9	10.6940	1.058
Exocoetidae			
<i>Parexocoetus brachypterus</i>	4	2.0622	0.204
<i>Prognichthys gibbifrons</i>	1	0.3426	0.034
Bregmacerotidae			
Bregmaceros Type A	6	9.0204	0.892
Bregmaceros Type B	107	266.0330	26.314
Mugilidae			
<i>Mugil</i> spp.	2	1.9081	0.189
Atherinidae	2	5.1041	0.505

Table 7. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Serranidae	10	44.4583	4.398
Diplectrum formosum	10	8.5387	0.845
Serranus spp.	2	2.1274	0.210
Hemanthias vivanus	5	9.1995	0.910
Pronotogrammus aureorubens	1	0.8567	0.085
Serraniculus pumilio	3	8.0410	0.795
Anthias Type 1	1	1.7456	0.173
Anthias Type 2	2	4.6498	0.460
Rypticus spp.	7	8.3296	0.824
Priacanthidae	8	9.5715	0.947
Apogonidae	38	41.8336	4.138
Branchiostegidae	1	1.0637	0.105
Carangidae			
Caranx spp.	2	3.3553	0.332
Decapterus punctatus	24	47.6104	4.709
Coryphaenidae			
Coryphaena spp.	2	3.4911	0.345

Table 7. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Lutjanidae	31	54.0492	5.346
<i>Pristipomoides aquilonaris</i>	1	9.9499	0.984
Gerreidae	5	11.5594	1.143
Pomadasyidae	3	2.6518	0.262
Sparidae	4	5.2593	0.520
Pomacentridae	8	9.1254	0.903
Labridae	24	37.8708	3.746
Scaridae	2	1.5761	0.156
Opistognathidae	3	2.9415	0.291
Blenniidae	1	1.1546	0.114
Clinidae	10	11.3253	1.120
Ophidiidae	77	84.8527	8.393
Carapidae			
<i>Echiodon</i> sp.	3	3.4423	0.341
Callionymidae	10	10.8374	1.072
Scombridae	3	5.2367	0.518
<i>Auxis</i> sp.	7	11.6485	1.152

Table 7. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Euthynnus alletteratus</i>	32	36.8370	3.644
<i>Thunnus atlanticus</i>	11	64.6038	6.390
Gempylidae	2	1.2839	0.127
Nomeidae			
<i>Cubiceps pauciradiatus</i>	1	1.7456	0.173
Arionmmidae			
<i>Arionma</i> spp.	8	8.8933	0.880
Gobiidae	312	375.2727	37.119
Scorpaenidae	61	73.8556	7.305
Triglidae	10	8.9223	0.882
Bothidae	12	18.8913	1.869
<i>Citharichthys cornutus</i>	60	98.4994	9.743
<i>Citharichthys macrops</i>	2	5.1041	0.505
<i>Citharichthys gymnorhinus</i>	10	20.7040	2.048
<i>Etropus rimosus</i>	28	28.0177	2.771
<i>Syacium papillosum</i>	121	268.3875	26.547
<i>Bothus robinsi</i>	51	63.8224	6.313
<i>Paralichthys</i> spp.	3	1.9258	0.191

Table 7. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Balistidae	29	40.3916	3.995
Tetraodontidae	38	44.0157	4.354
Tetraodontidae	38	44.0157	4.354
Lophiiformes	21	34.0839	3.371
Unidentified Larvae	251	310.2394	30.686
Total Larvae	2,149	3,079.4102	304.591
NUMBER OF FAMILIES:	45		
NUMBER OF SPECIES:	32		

Table 8. Cruise 8C 7120-TI 7121. Numbers of larvae, estimated total abundance in the area represented by the cruise ($189.43 \times 10^9 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeiformes	1	0.4314	0.023
Clupeidae	58	14.6986	0.776
Harengula jaguana	13	3.8911	0.205
Opisthonema oglinum	1,101	209.8179	11.076
Sardinella anchovia	389	79.4919	4.196
Engraulidae	503	270.5702	14.283
Bathylagidae	1	1.2381	0.065
Gonostomatidae	64	71.8481	3.793
Cyclothone spp.	122	113.5732	5.996
Gonostoma elongatum	32	35.1085	1.853
Margrethia obtusirostra	1	1.4766	0.078
Maurolicus muelleri	131	101.6345	5.365
Polymetme (?) Type I	5	9.4732	0.500
Vinciguerria spp.	3	3.9040	0.206
Vinciguerria nimbaria	31	42.1581	2.226
Vinciguerria poweriae	12	9.6291	0.508
Vinciguerria attenuata	10	9.2752	0.490

Table 8. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Sternoptychidae	4	3.8388	0.203
Argyropelecus spp.	24	26.0583	1.376
Sternoptyx spp.	50	57.4904	3.035
Stomiatidae			
Stomias spp.	3	3.6213	0.191
Chauliodontidae			
Chauliodus spp.	2	2.9137	0.154
Melanostomiatidae	2	2.0664	0.109
Synodontidae	1,124	395.7673	20.893
Saurida brasiliensis	3	0.6147	0.033
Aulopidae			
Aulopus nanus	1	0.5023	0.027
Scopelarchidae	3	3.0464	0.161
Evermannellidae			
Coccorella atrata	1	1.5174	0.080
Paralepididae	71	66.2485	3.497
Myctophidae	77	84.5899	4.466
Bolinichthys spp.	4	1.6018	0.085

Table 8. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Diaphus spp.	850	585.3945	30.903
Diaphus dumerili	7	8.1269	0.429
Diaphus lucidus	1	1.5460	0.082
Diaphus taaningi	1	0.8541	0.045
Diaphus bertelseni	1	1.5174	0.080
Notolychnus valdiviae	42	41.9692	2.216
Lampadena luminosa	16	17.1013	0.903
Lampanyctus spp.	12	13.8558	0.731
Lampanyctus alatus	13	13.1421	0.694
Lampanyctus cuprarius	4	5.2859	0.279
Myctophum nitidulum	159	148.3084	7.829
Myctophum selenops	25	27.2061	1.436
Ceratoscopelus warmangi	10	9.5497	0.504
Hygophum spp.	29	27.4576	1.450
Hygophum reinhardti	4	4.0309	0.213
Hygophum benoiti	1	1.0800	0.057
Centrobranchus nigroocellatus	9	10.9264	0.577

Table 8. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Gonichthys coccoi</i>	1	0.9879	0.052
<i>Lepidophanes</i> spp.	33	27.9391	1.475
<i>Notoscopelus resplendens</i>	1	0.9879	0.052
<i>Lobiancha gemellari</i>	3	3.2634	0.172
<i>Benthoosema suborbitale</i>	33	33.8065	1.785
<i>Diogenichthy atlanticus</i>	16	18.0489	0.953
Chlorophthalmidae			
<i>Chlorophthalmus agassizi</i>	3	3.0826	0.163
Notosudidae			
<i>Scopelosaurus maui</i>	1	0.8688	0.046
Anguilliformes	12	12.2980	0.649
Muraenidae	10	4.6948	0.248
<i>Gymnothorax nigromarginatus</i>	26	7.5460	0.398
Nettastomidae	12	11.0613	0.584
<i>Hoplunnis diomedianus</i>	9	2.7003	0.143
<i>Hoplunnis macrurus</i>	4	1.8404	0.097
Congridae	6	2.5106	0.158
<i>Ariosoma balearicum</i>	2	3.0028	0.159

Table 8. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Paraconger caudilimbatus</i>	22	15.3633	0.811
<i>Hildebrancia gracilior</i>	20	16.0498	0.847
<i>Nistactichthys</i> spp.	5	1.1201	0.059
Ophichthidae	21	8.9492	0.472
<i>Ophichthys</i> spp.	26	11.5442	0.609
Dysommidae	1	0.7042	0.037
Belonidae	1	0.3698	0.020
Hemiramphidae			
<i>Hemiramphus balao</i>	5	2.0439	0.108
<i>Oxyporhamphus micropterus</i>	1	0.2221	0.012
Exocoetidae	3	1.1707	0.062
<i>Parexocoetus brachypterus</i>	6	1.0005	0.053
<i>Cypselurus</i> spp.	4	1.8199	0.096
<i>Prognichthys gibbifrons</i>	7	3.7621	0.199
Bregmacerotidae			
<i>Bregmaceros atlanticus</i>	74	68.1572	3.598
<i>Bregmaceros</i> Type A	169	46.5787	2.459

Table 8. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Bregmaceros Type B	370	100.2908	5.294
Bregmaceros macclellandi	11	12.8030	0.676
Syngnathidae			
Hippocampus erectus	1	0.0480	0.003
Syngnathus spp.	1	0.0946	0.005
Syngnathus elucens	7	0.9712	0.051
Melamphaeidae			
Melamphaes spp.	7	8.4706	0.447
Holocentridae	2	0.8229	0.043
Caproidae			
Antigonia spp.	7	2.3988	0.127
Antigonia capros	1	0.2115	0.011
Mugilidae			
Mugil spp.	2	0.4624	0.024
Sphyraenidae			
Sphyraena barracuda	8	3.3486	0.177
Serranidae	63	22.0962	1.166
Diplectrum formosum	199	54.2876	2.866

Table 8. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Serranus</i> spp.	3	1.7467	0.092
<i>Hemanthias vivanus</i>	8	2.5570	0.135
<i>Pronotogrammus aureorubens</i>	3	1.5441	0.082
<i>Serraniculus pumilio</i>	56	16.6765	0.880
<i>Liopropoma</i> spp.	6	6.5444	0.346
<i>Liopropoma</i> Type 1	4	2.4925	0.132
<i>Liopropoma</i> Type 2	1	1.2381	0.065
<i>Anthias</i> Type 1	2	0.8047	0.042
<i>Anthias</i> Type 2	1	0.3262	0.017
<i>Rypticus</i> spp.	43	10.5891	0.559
<i>Rypticus saponaceus</i>	4	1.0525	0.056
<i>Rypticus maculatus</i>	1	0.3862	0.020
Priacanthidae	36	13.1422	0.694
<i>Priacanthus arenatus</i>	1	0.2115	0.011
<i>Pseudopriacanthus altus</i>	7	2.9490	0.156
Apogonidae	341	88.4145	4.667
Branchiostegidae	1	1.4766	0.078
<i>Caulolatilus</i> spp.	6	1.2690	0.067

Table 8. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Echeneidae	2	0.5074	0.027
Rachycentridae			
Rachycentron canadum	2	0.4179	0.022
Carangidae	5	6.3645	0.336
Caranx spp.	31	29.8920	1.578
Caranx crysos	12	4.7520	0.251
Chloroscombrus chrysurus	312	95.7282	5.054
Decapterus punctatus	406	123.7808	6.534
Selene vomer	13	11.1354	0.588
Trachinotus spp.	1	0.0994	0.005
Vomer setapinnis	1	0.5925	0.031
Coryphaenidae			
Coryphaena hippurus	1	0.9879	0.052
Lutjanidae	418	119.2489	6.295
Pristipomoides aquilonaris	13	7.8687	0.415
Rhomboplites aurorubens	10	2.4620	0.130
Acanthuridae			
Acanthurus spp.	1	2.2261	0.118

Table 8. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Gerreidae	187	39.8076	0.210
Pomadasyidae	59	12.6966	0.670
Sciaenidae	1	0.0843	0.084
Cynoscion nebulosus	3	0.6639	0.035
Sparidae	5	2.0539	0.108
Mullidae	2	0.5140	0.027
Chaetodontidae	1	0.4267	0.022
Pomacentridae	20	9.2346	0.488
Labridae	846	506.2123	26.723
Scaridae	62	68.3652	3.609
Blenniidae	120	11.9689	0.632
Clinidae	41	10.8472	0.573
Ophidiidae	191	66.5163	3.511
Carapidae			
Carapus bermudensis	5	1.5024	0.079
Echiodon sp.	72	24.8320	1.311
Callionymidae	32	63.5615	3.355

Table 8. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Scombridae	74	48.8695	2.580
Auxis sp.	172	107.0895	5.653
Euthynnus alletteratus	176	97.0290	5.122
Katsuwonus pelamis	22	23.8850	1.261
Thunnus spp.	9	7.6738	0.405
Thunnus atlanticus	127	81.3012	4.292
Scomberomorus maculatus	2	0.6670	0.035
Gempylidae	10	11.4926	0.607
Stromateidae			
Peprilus paru	1	0.3782	0.020
Peprilus burti	2	1.1797	0.062
Nomeidae			
Cubiceps pauciradiatus	53	64.1235	3.385
Psenes spp.	4	3.8251	0.202
Arionmmidae			
Arionmma spp.	16	11.2807	0.596
Gobiidae	2,799	778.0021	41.071
Scorpaenidae	311	92.8222	4.900

Table 8. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Triglidae	114	33.1600	1.751
Pleuronectiformes	2	2.4514	0.129
Bothidae	16	9.5678	0.505
Citharichthys spp.	1	0.3690	0.020
Citharichthys cornutus	181	76.3641	4.031
Citharichthys macrops	27	7.7705	0.410
Citharichthys spilopterus	11	9.5788	0.506
Citharichthys gymnorhinus	104	23.9275	1.263
Cyclopsetta fimbriata	15	6.6794	0.353
Etropus rimosus	26	8.7177	0.460
Syacium papillosum	1,359	507.1625	26.773
Engyophrys senta	9	5.1618	0.273
Monolene sessilicauda	4	1.1297	0.060
Trichopsetta ventralis	2	3.0953	0.163
Bothus robinsi	429	162.7166	8.590
Soleidae			
Achirus lineatus	2	0.5109	0.027

Table 8. Continued.

Taxa		Number of larvae	Abundance (x 10 ⁹)	Mean Number under 10 m ²
Cynoglossidae				
	Symphurus spp.	253	80.4855	4.249
	Balistidae	293	72.7517	3.841
	Ostraciidae	2	0.2356	0.012
	Tetraodontidae	98	24.3759	1.287
	Diodontidae	1	0.3262	0.017
	Lophiiformes	247	106.9340	5.645
	Unidentified Larvae	1,236	305.6079	16.133
	Total Larvae	18,037	7,221.1314	381.203
NUMBER OF FAMILIES:	70			
NUMBER OF SPECIES:	96			

Table 9. Cruise TI 7131-8B 7132. Numbers of larvae, estimated total abundance in the area represented by the cruises ($72.99 \times 10^9 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeiformes	1	0.3192	0.044
Clupeidae	1	0.2381	0.033
Brevoortia spp.	1	0.4013	0.055
Etrumeus teres	72	29.3876	4.026
Sardinella anchovia	55	29.0593	3.981
Engraulidae	72	24.0410	3.294
Argentinidae			
Argentina spp.	13	3.9432	0.540
Nansenia spp.	1	0.4718	0.065
Bathylagidae	2	0.7454	0.102
Gonostomatidae	22	7.3770	1.011
Cyclothone spp.	32	13.0885	1.793
Gonostoma spp.	3	1.1180	0.153
Gonostoma elongatum	24	10.3076	1.412
Ichthyococcus ovatus	1	0.2801	0.038
Maurolicus muelleri	17	6.9854	0.957
Pollichthys maui	1	0.2800	0.038
Polymetme (?) Type I	2	0.9435	0.129

Table 9. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Vinciguerrria spp.	1	0.3727	0.051
Vinciguerrria nimbaria	6	1.7952	0.246
Vinciguerrria poweriae	14	4.0382	0.553
Vinciguerrria attenuata	3	0.8888	0.122
Sternoptychidae	1	0.3918	0.054
Argyropelecus spp.	2	2.4148	0.331
Polyipnus spp.	3	0.9860	0.135
Stomiatidae			
Stomias spp.	2	2.4546	0.336
Chauliodontidae			
Chauliodus spp.	1	0.3685	0.051
Melanostomiatidae	2	0.5695	0.078
Synodontidae	289	93.3248	12.786
Scopelarchidae	4	1.4754	0.202
Evermannellidae	1	0.3685	0.051
Paralepididae	24	7.7494	1.062
Myctophidae	24	7.3209	1.132
Diaphus spp.	40	20.9216	2.866

Table 9. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Notolychnus valdiviae</i>	19	5.7420	0.787
<i>Lampadena luminosa</i>	2	0.4341	0.060
<i>Lampanyctus alatus</i>	5	2.2752	0.312
<i>Myctophum asperum</i>	1	0.2801	0.038
<i>Myctophum nitidulum</i>	15	6.7891	0.930
<i>Myctophum selenops</i>	5	1.7772	0.244
<i>Ceratoscopelus warmingi</i>	1	2.0861	0.286
<i>Hygophum</i> spp.	20	9.6984	1.329
<i>Hygophum reinhardti</i>	13	6.4757	0.887
<i>Centrobranchus nigroocellatus</i>	4	1.3663	0.187
<i>Lepidophanes</i> spp.	30	16.5148	2.263
<i>Benthoosema suborbitale</i>	22	6.9636	0.954
<i>Diogenichthys atlanticus</i>	18	7.3841	1.012
Chlorophthalmidae			
<i>Chlorophthalmus agassizi</i>	1	0.3918	0.054
Anguilliformes	6	4.1340	0.566
Muraenidae	3	1.0961	0.150
<i>Gymnothorax nigromarginatus</i>	6	1.1994	0.164

Table 9. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Nettastomidae	2	0.5320	0.073
Hoplunnis diomedianus	1	0.1526	0.021
Hoplunnis tenuis	1	0.3287	0.045
Congridae	2	0.7411	0.102
Gnathophis spp.	2	0.5992	0.082
Hildebrandia flava	2	0.6383	0.088
Hildebrandia gracilior	5	5.7737	0.791
Nystactichthys spp.	2	0.9526	0.131
Ophichthidae	7	2.5314	0.347
Ophichthus spp.	1	0.2178	0.030
Myrophis punctatus	8	5.6675	0.776
Hemiramphidae			
Hyporhamphus unifasciatus	2	1.023	0.140
Exocoetidae			
Prognichthys gibbifrons	1	0.3287	0.045
Gadidae			
Urophycis spp.	5	1.613	0.221

Table 9. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Bregmacerotidae			
Bregmaceros spp.	1	0.3918	0.054
Bregmaceros atlanticus	51	19.8107	2.714
Bregmaceros Type A	84	29.0932	3.986
Bregmaceros Type B	335	102.3036	14.016
Bregmaceros macclellandi	3	1.0561	0.145
Macrouridae	1	0.3287	0.045
Syngnathidae			
Hippocampus erectus	3	1.6230	0.222
Syngnathus spp.	1	0.7268	0.110
Syngnathus dunckeri	1	0.6569	0.090
Syngnathus springeri	2	0.5626	0.077
Syngnathus scovelli	6	0.8165	0.112
Melamphaeidae			
Melamphaes spp.	5	1.7114	0.235
Holocentridae			
Adioryx vexillarius	1	2.0861	0.286

Table 9. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Caproidae			
Antigonia spp.	21	6.3508	0.870
Antigonia capros	1	0.3192	0.044
Mugilidae			
Mugil spp.	2	1.7281	0.237
Serranidae	51	21.9570	3.008
Diplectrum formosum	14	5.3908	0.739
Serranus spp.	17	6.2894	0.862
Centropristis striata	12	7.5052	1.028
Hemanthias vivanus	68	22.6034	3.097
Serraniculus pumilio	3	0.7711	0.106
Anthias Type 1	15	3.9178	0.537
Anthias Type 3	2	0.7369	0.101
Rypticus saponaceus	1	0.2167	0.030
Apogonidae	18	6.1910	0.848
Carangidae			
Decapterus punctatus	145	61.0384	8.363
Seriola spp.	4	1.5705	0.215

Table 9. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Trachurus lathami</i>	4	1.9979	0.274
Bramidae	1	0.2609	0.036
Lutjanidae	7	1.8331	0.251
<i>Pristipomoides aquilonaris</i>	1	0.2800	0.038
<i>Rhomboplites aurorubens</i>	6	1.2246	0.168
<i>Symphysanodon typus</i>	2	0.7369	0.101
Acanthuridae			
<i>Acanthurus</i> spp.	3	0.9772	0.134
Gerreidae	7	1.8617	0.255
Pomadasyidae	4	1.8028	0.247
Sciaenidae	5	2.4310	0.333
<i>Cynoscion nothus</i>	1	0.3022	0.041
<i>Leiostomus xanthurus</i>	10	3.9120	0.536
<i>Menticirrhus americanus</i>	2	0.9724	0.133
<i>Micropogon undulatus</i>	4	1.7633	0.242
Sparidae	9	4.9192	0.674
<i>Lagodon rhomboides</i>	2	0.4662	0.064
Mullidae	1	0.4718	0.065

Table 9. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Kyphosidae			
Kyphosus spp.	2	0.5219	0.072
Chaetodontidae	1	0.3727	0.051
Pomacentridae	15	8.3056	1.138
Labridae	39	27.1361	3.718
Scaridae	37	12.6697	1.736
Opistognathidae	3	0.9648	0.135
Uranoscopidae			
Astroscopus y-graecum	1	0.1604	0.022
Blenniidae	21	7.4940	1.027
Clinidae	33	11.8556	1.624
Ophidiidae	122	43.9807	6.026
Carapidae			
Carapus bermudensis	1	0.1933	0.026
Echiodon sp.	24	11.2768	1.545
Callionymidae	56	16.8800	2.313
Scombridae			
Auxis sp.	1	0.3110	0.043

Table 9. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Gempylidae	18	5.4731	0.750
Nomeidae			
Cubiceps pauciradiatus	1	0.7268	0.110
Psenes pellucidus	1	0.2800	0.038
Arionmmidae			
Arionmma spp.	7	2.2875	0.313
Gobiidae	570	191.7677	26.273
Scorpaenidae	77	27.9653	1.831
Triglidae	261	110.0949	15.084
Bothidae	33	9.7982	1.342
Citharichthys cornutus	17	8.0249	1.099
Citharichthys macrops	13	6.6344	0.909
Citharichthys gymnorhinus	6	1.5868	0.217
Etropus rimosus	133	50.6006	6.933
Syacium papillosum	62	20.8997	2.863
Monolene sessilicauda	2	4.1723	0.572
Bothus robinsi	152	79.2961	10.864
Paralichthys spp.	4	2.0588	0.282

Table 9. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Cynoglossidae			
Symphurus spp.	6	1.7197	0.236
Balistidae	3	1.7270	0.237
Tetraodontidae	18	7.3629	1.009
Gobiesocidae	1	0.3161	0.043
Lophiiformes	76	21.1646	2.900
Unidentified Larvae	271	111.1779	15.232
Total Larvae	3,974	1,514.1253	207.443
NUMBER OF SPECIES:	69		
NUMBER OF FAMILIES:	66		

Table 10. Cruise 8B 7201-GE 7202. Numbers of larvae, estimated total abundance in the area represented by the cruise ($148.85 \times 10^9 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeidae	10	13.8444	0.930
Brevoortia spp.	2	1.7031	0.114
Etrumeus teres	190	269.9549	18.136
Sardinella anchovia	68	69.5307	4.671
Engraulidae	8	5.8271	0.392
Gonostomatidae	5	10.7474	0.722
Cyclothone spp.	12	15.2119	1.022
Gonostoma elongatum	2	4.2314	0.284
Ichthyococcus ovatus	1	1.9452	0.131
Maurollicus muelleri	10	19.4515	1.307
Vinciguerrria nimbaria	9	11.2375	0.754
Vinciguerrria poweriae	1	1.9452	0.131
Stomiatidae			
Stomias spp.	1	1.0321	0.0693
Synodontidae	137	201.6463	13.547
Paralepididae	10	12.4177	0.834
Myctophidae	6	15.2659	1.026
Diaphus spp.	49	66.0673	4.439

Table 10. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Notolychnus valdiviae</i>	3	6.8587	0.461
<i>Lampanyctus</i> spp.	3	3.6113	0.243
<i>Myctophum nitidulum</i>	7	18.8876	1.269
<i>Myctophum selenops</i>	1	2.2862	0.154
<i>Ceratoscopelus warmingi</i>	1	0.7232	0.049
<i>Hygophum reinhardti</i>	6	13.4243	0.902
<i>Lepidophanes</i> spp.	10	9.8587	0.662
<i>Notoscopelus resplendens</i>	2	3.9058	0.262
<i>Benthosema suborbitale</i>	3	6.5176	0.438
Anguilliformes	1	2.862	0.154
Nettastomidae	5	7.3016	0.491
<i>Hoplunnis diomedianus</i>	4	5.9820	0.402
Congridae			
<i>Ariosoma balearicum</i>	1	2.2862	0.154
<i>Hildebrandia gracilior</i>	2	1.4465	0.097
Ophichthidae	11	20.3396	1.366
<i>Ophichthus</i> spp.	1	1.3296	0.089
<i>Myrophis punctatus</i>	2	3.6159	0.243

Table 10. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Hemiramphidae			
Hyporhamphus unifasciatus	2	2.4831	0.167
Exocoetidae			
Parexocoetus brachypterus	1	0.9300	0.063
Gadidae			
Urophycis spp.	12	22.5033	1.512
Bregmacerotidae			
Bregmaceros spp.	2	3.6514	0.245
Bregmaceros atlanticus	6	10.8056	0.726
Bregmaceros Type a	14	21.9474	1.475
Bregmaceros Type B	60	89.6620	6.024
Syngnathidae			
Syngnathus elucens	1	1.3240	0.089
Syngnathus pelagicus	1	2.2862	0.154
Syngnathus springeri	2	1.8373	0.123
Mugilidae			
Mugil spp.	17	17.1987	1.155

Table 10. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Serranidae	54	38.0142	2.651
Diplectrum formosum	14	17.5192	1.177
Epinephelus spp.	1	1.0321	1.678
Serranus spp.	3	6.8587	0.461
Centropristis striata	15	15.5541	1.045
Hemanthias vivanus	1	0.7232	0.049
Pronotogrammus aureorubens	5	7.2992	0.490
Anthias spp.	3	4.5311	0.304
Anthias Type 3	1	0.6626	0.044
Apogonidae	28	24.9801	1.678
Branchiostegidae			
Caulolatilus spp.	1	1.6195	0.109
Carangidae	1	0.6591	0.044
Caranx spp.	1	2.2862	0.154
Decapterus punctatus	33	27.7672	1.865
Seriola spp.	1	0.9300	0.063
Trachurus lathami	33	42.0272	2.824
Bramidae	1	0.7232	0.049

Table 10. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Lutjanidae	1	0.6591	0.044
Symphysanodon typus	1	1.0321	0.069
Acanthuridae			
Acanthurus spp.	1	0.7232	0.049
Gerreidae	10	11.7422	0.789
Pomadasyidae	43	40.6031	2.728
Orthopristis chrysoptera	5	3.9376	0.264
Sciaenidae			
Cynoscion nebulosus	1	1.1647	0.078
Leiostomus xanthurus	8	9.6762	0.650
Sparidae	11	8.1081	4.152
Lagodon rhomboides	120	174.5743	11.728
Pagrus pagrus	3	2.4494	0.165
Mullidae	34	45.2285	3.039
Pomacentridae	10	9.9206	0.666
Labridae	38	44.9950	3.023
Scaridae	16	17.5285	1.178

Table 10. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Opistognathidae	6	7.1040	0.477
Blenniidae	22	26.4104	1.774
Clinidae	9	11.8763	0.798
Ophidiidae	38	49.3893	3.320
Carapidae			
Echiodon sp.	3	2.5986	0.175
Callionymidae	14	1.4722	0.989
Scombridae			
Auxis sp.	3	2.7267	0.183
Euthynnus alletteratus	1	0.6591	0.044
Scomber japonicus	2	2.4255	0.163
Gempylidae	1	0.6626	0.044
Nomeidae			
Cubiceps pauciradiatus	3	2.6456	0.178
Psenes cyanophrys	1	0.6626	0.045
Psenes pellucidus	1	0.6626	0.045
Arionmmidae			
Arionmma spp.	6	5.8230	0.391

Table 10. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Gobiidae	249	342.0611	22.980
Scorpaenidae	30	32.0859	2.156
Triglidae	34	48.3453	3.248
Bothidae	8	10.8403	0.728
Citharichthys cornutus	6	15.1173	1.016
Citharichthys macrops	7	7.2236	0.485
Citharichthys gymnorhinus	21	30.3619	2.040
Cyclopsetta fimbriata	1	0.6591	0.044
Etropus rimosus	116	173.8785	11.682
Syacium papillosum	58	38.2253	2.568
Bothus robinsi	20	21.7582	1.462
Soleidae			
Achirus lineatus	1	1.0321	0.069
Cynoglossidae			
Symphurus spp.	1	1.3240	0.089
Balistidae	41	53.1917	3.574
Tetraodontidae	36	52.7788	3.546

Table 10. Continued.

Taxa	Number of larvae	Abundance (x 10 ⁹)	Mean Number under 10 m ²
Lophiiformes	2	5.2378	0.352
Unidentified Larvae	307	415.9357	27.943
Total Larvae	2,290	3,006.6007	201.989
NUMBER OF FAMILIES:	47		
NUMBER OF SPECIES:	54		

Table 11. Cruise GE 7208. Numbers of larvae, estimated total abundance in the area represented by the cruise ($124.88 \times 10^6 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeiformes	3	4.7997	0.384
Clupeidae	3	1.3840	0.111
Etrumeus teres	4	6.4008	0.513
Harengula jaguana	95	18.7910	1.507
Opisthonema oglinum	634	205.2583	16.436
Sardinella anchovia	118	64.0501	5.129
Engraulidae	220	112.8559	9.037
Argentinidae	2	4.4200	0.354
Gonostomatidae	41	92.1588	7.380
Cyclothone spp.	56	112.2859	8.992
Gonostoma elongatum	9	22.7617	1.823
Maurolicus muelleri	1	1.7854	0.143
Polymetme (?) Type I	2	5.3939	0.432
Vinciguerrria spp.	17	43.3219	0.346
Vinciguerrria nimbaria	22	45.2934	3.627
Vinciguerrria poweriae	13	25.9692	2.080
Vinciguerrria attenuata	3	9.9517	0.797

Table 11. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Sternoptychidae			
Argyropelecus spp.	2	3.6336	0.291
Sternoptyx spp.	4	11.3654	0.910
Stomiatidae			
Stomias spp.	2	3.6669	0.294
Astronesthidae	1	1.8168	0.146
Melanostomiatidae	2	3.6336	0.291
Synodontidae	233	247.9351	19.854
Aulopidae			
Aulopus nanae	1	1.0262	0.082
Scopelarchidae	1	1.8168	0.146
Evarmannellidae	2	6.6344	0.531
Paralepididae	34	62.2509	4.985
Myctophidae	51	84.6991	6.782
Diaphus spp.	192	298.5779	23.909
Notolychnus valdiviae	49	118.3478	9.477
Lampadena luminosa	9	15.1175	1.211
Lampanyctus spp.	8	14.2649	1.142

Table 11. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Lampanyctus alatus</i>	3	6.4745	0.519
<i>Lampanyctus ater</i>	2	3.6336	0.291
<i>Lampanyctus cuprarius</i>	3	4.3879	0.351
<i>Myctophum</i> spp.	2	2.5394	0.203
<i>Myctophum nitidulum</i>	104	225.1198	18.027
<i>Myctophum selenops</i>	35	85.0125	6.808
<i>Ceratoscopelus warmingi</i>	38	62.6800	5.019
<i>Hygophum</i> spp.	109	195.9784	15.693
<i>Hygophum reinhardti</i>	8	17.7136	1.419
<i>Centrobranchus nigroocellatus</i>	6	14.9990	1.201
<i>Gonichthys coccoi</i>	1	3.3172	0.266
<i>Lepidophanes</i> spp.	91	183.1031	14.662
<i>Notoscopelus resplendens</i>	2	2.5394	0.203
<i>Lobianchia gemellari</i>	8	16.4173	1.315
<i>Benthoosema suborbitale</i>	144	370.3809	29.659
<i>Diogenichthys atlanticus</i>	34	79.5582	6.371
<i>Symbolophorus rufinus</i>	9	18.2886	1.464

Table 11. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Chlorophthalmidae			
Chlorophthalmus agassizi	3	7.6264	0.611
Anguilliformes	5	9.1993	0.737
Muraenidae	4	9.4029	0.753
Gymnothorax spp.	1	1.0559	0.085
Nettastomidae	3	4.5970	0.368
Hoplunnis diomedianus	1	1.8642	0.149
Hoplunnis macrurus	1	1.8168	0.146
Congridae	1	1.8642	0.149
Xenomystax spp.	2	3.6336	0.291
Ophichthidae	2	2.4920	0.120
Ahlia egmontis	2	1.2028	0.096
Exocoetidae	1	1.0559	0.085
Prognichthys gibbifrons	3	2.1529	0.172
Bregmacerotidae			
Bregmaceros atlanticus	23	61.7324	4.943
Bregmaceros Type A	52	110.4760	8.847
Bregmaceros Type B	19	18.9033	1.514

Table 11. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Syngnathidae			
Hippocampus erectus	1	0.4762	0.038
Syngnathus elucens	2	0.8632	0.069
Syngnathus springeri	1	0.3266	0.026
Syngnathus scovelli	4	0.6399	0.051
Melamphaeidae			
Melamphaes spp.	8	16.6789	1.336
Holocentridae	15	46.7261	3.742
Mugilidae			
Mugil spp.	13	4.1812	0.335
Sphyraenidae			
Sphyraena barracuda	1	3.3172	0.266
Sphyraena borealis	3	2.1642	0.173
Sphyraena guachancho	1	1.0262	0.082
Serranidae	25	33.8362	2.710
Diplectrum formosum	374	194.4743	15.573

Table 11. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
<i>Epinephelus</i> spp.	29	20.6294	1.652
<i>Serranus</i> spp.	7	14.5788	1.167
<i>Hemanthias vivanus</i>	50	49.0193	3.925
<i>Pronotogrammus aureorubens</i>	11	12.7316	1.020
<i>Serraniculus pumilio</i>	12	4.2296	0.339
<i>Liopropoma</i> spp.	1	3.3172	0.266
<i>Rypticus</i> spp.	1	0.3773	0.030
Priacanthidae	8	7.6778	0.615
<i>Priacanthus cruentatus</i>	1	3.3172	0.266
Apogonidae	163	95.1710	7.621
Echeneidae	1	1.8168	0.146
Carangidae			
<i>Caranx</i> spp.	1	0.8255	0.066
<i>Chloroscombrus chrysurus</i>	3	0.1376	0.011
<i>Decapterus punctatus</i>	352	238.6873	19.113
<i>Elegatis bipinnulata</i>	6	6.3357	0.507
<i>Seriola</i> spp.	3	6.1645	0.494
<i>Trachurus lathami</i>	8	10.4582	0.838

Table 11. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Bramidae	2	3.6336	0.291
Coryphaenidae			
Coryphaena spp.	2	2.8473	0.228
Lutjanidae	41	32.1108	2.571
Lutjanus spp.	2	2.7685	0.222
Acanthuridae			
Acanthurus spp.	2	4.3434	0.348
Gerreidae	193	27.8538	2.230
Pomadasyidae	202	75.2630	6.027
Orthopristis chrysoptera	2	0.3199	0.026
Sciaenidae			
Cynoscion nebulosus	37	5.8046	0.465
Leiostomus xanthurus	26	4.1591	0.333
Micropogon undulatus	1	0.1600	0.013
Sparidae	38	19.1074	1.530
Lagodon rhomboides	1	0.1600	0.013
Mullidae	47	28.8256	2.308
Mullus auratus	2	1.0065	0.081

Table 11. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Chaetodontidae	4	3.5324	0.283
Pomacentridae	52	65.4344	5.240
Labridae	159	145.8946	11.683
Scaridae	77	91.3695	7.317
Opistognathidae	59	27.3802	2.193
Blenniidae	104	61.3080	4.909
Clinidae	41	23.7295	1.900
Ophidiidae	214	138.7797	11.113
Carapidae			
Carapus bermudensis	1	3.3172	0.266
Echiodon sp.	2	5.1340	0.411
Callionymidae	28	36.9887	2.962
Scombridae			
Auxis sp.	37	44.6725	3.577
Euthynnus alleteratus	10	23.8967	1.914
Katsuwonus pelamis	13	23.3509	1.870
Thunnus atlanticus	5	9.5229	0.763

Table 11. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
<i>Thunnus thynnus</i>	77	215.0550	17.221
<i>Scomberomorus maculatus</i>	2	0.8468	0.068
<i>Acanthocybium solanderi</i>	1	2.0767	0.166
Gempylidae	8	12.3373	0.988
Nomeidae			
<i>Cubiceps pauciradiatus</i>	10	15.4548	1.238
<i>Psenes pellucidus</i>	1	1.0262	0.082
Ariommidae			
<i>Ariomma</i> spp.	11	22.6366	1.813
Gobiidae	657	426.8858	34.184
Scorpaenidae	131	99.7413	7.987
Triglidae	66	35.0485	2.807
Bothidae	4	5.0542	0.405
<i>Citharichthys cornutus</i>	53	95.4699	7.645
<i>Citharichthys macrops</i>	11	3.4362	0.275
<i>Citharichthys gymnorhinus</i>	4	2.2322	0.179
<i>Cyclopsetta fimbriata</i>	6	2.7291	0.219

Table 11. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Etropus rimosus</i>	47	27.1966	2.178
<i>Syacium papillosum</i>	102	94.1521	7.539
<i>Monolene sessilicauda</i>	3	4.5539	0.365
<i>Bothus robinsi</i>	44	53.2162	4.261
Soleidae			
<i>Achirus lineatus</i>	2	0.3199	0.013
Cynoglossidae			
<i>Symphurus</i> spp.	68	34.2732	2.744
Balistidae	321	175.7871	14.077
Tetraodontidae	58	33.7350	2.701
Diodontidae	1	1.8168	0.146
Lophiiformes	27	35.4842	2.842
Unidentified Larvae	670	623.1916	49.903
Total Larvae	7,450	6,899.5027	552.491
NUMBER OF FAMILIES:	63		
NUMBER OF SPECIES:	77		

Table 12. Cruise GE 7210. Numbers of larvae, estimated total abundance in the area represented by the cruise ($48.43 \times 10^9 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeidae	10	6.3027	1.301
Harengula jaguana	110	29.1211	6.013
Opisthonema oglinum	1,016	836.8930	172.805
Sardinella anchovia	94	98.8491	20.411
Engraulidae	12	8.4291	1.741
Synodontidae	37	23.3856	4.829
Muraenidae			
Gymnothorax nigromarginatus	4	2.7714	0.572
Hemiramphidae			
Hyporhamphus unifasciatus	2	0.5652	0.117
Hemiramphus brasiliensis	1	0.5980	0.124
Syngnathidae			
Hippocampus erectus	1	0.3388	0.070
Syngnathus scovelli	2	0.5108	0.106
Mugilidae			
Mugil spp.	1	0.5980	0.124
Atherinidae			
Membras martinicus	37	8.3764	1.730

Table 12. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Serranidae			
Diplectrum formosum	51	27.5778	5.694
Serraniculus pumilio	6	2.8643	0.591
Priacanthidae	2	2.2250	0.459
Apogonidae	32	25.1453	5.192
Carangidae			
Decapterus punctatus	117	84.8085	17.512
Oligoplites saurus	1	0.2264	0.047
Lutjanidae	45	35.7947	7.391
Rhomboplites aurorubens	1	1.0443	0.216
Gerreidae	22	9.2763	1.920
Pomadasyidae	27	16.5817	3.424
Sparidae	7	4.2915	0.886
Pomacentridae	3	1.9986	0.413
Labridae	5	5.2640	1.087
Scaridae	6	4.8894	1.010
Opistognathidae	6	5.0346	1.040
Blenniidae	21	8.3474	1.724

Table 12. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clinidae	25	6.5589	1.354
Ophidiidae	47	39.1869	8.092
Callionymidae	31	14.0542	2.902
Scombridae			
Auxis sp.	3	2.6747	0.552
Euthynnus alletteratus	5	3.4220	0.707
Gobiidae	204	159.6969	32.975
Scorpaenidae	25	19.4112	4.008
Triglidae	9	5.8137	1.200
Bothidae			
Citharichthys macrops	9	3.7573	0.776
Cyclopsetta fimbriata	2	1.9874	0.410
Etropus rimosus	3	3.1548	0.651
Syacium papillosum	22	17.8605	3.688
Bothus robinsi	4	4.0651	0.839
Soleidae			
Gymnachirus melas	1	0.6507	0.134

Table 12. Continued.

Taxa		Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Cynoglossidae				
	Symphurus spp.	16	13.3302	2.753
Balistidae		58	42.2547	8.725
Ostraciidae		1	0.4261	0.088
Tetraodontidae		16	10.5470	2.178
Lophiiformes		6	3.9664	0.819
Unidentified Larvae		71	31.7841	6.563
Total Larvae		2,239	1,637.9448	338.209
NUMBER OF FAMILIES:		34		
NUMBER OF SPECIES:		23		

Table 13. Cruise IS 7205. Numbers of larvae, estimated total abundance in the area represented by the cruise ($104.59 \times 10^3 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeidae	43	26.1144	2.497
Harengula jaguana	5	1.6629	0.159
Opisthonema oglinum	76	11.0083	1.053
Sardinella anchovia	3,726	2,241.3012	214.294
Engraulidae	28	20.7727	1.986
Gonostomatidae			
Cyclothone spp.	10	25.6030	2.448
Gonostoma atlanticum	2	4.1059	0.393
Gonostoma elongatum	5	10.2647	0.981
Maurolicus muelleri	1	3.5409	0.339
Vinciguerrria nimbaria	5	13.3613	1.278
Synodontidae	145	159.0368	15.206
Aulopidae			
Aulopus nanai	1	2.0529	0.196
Scopelarchidae	1	2.0529	0.196
Paralepididae	1	2.8573	0.273
Myctophidae			
Bolinichthys spp.	1	1.8092	0.173

Table 13. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Diaphus spp.	25	63.8289	6.103
Notolychnus valdiviae	2	6.3982	0.612
Myctophum nitidulum	2	3.5758	0.3429
Myctophum selenops	1	2.0529	0.196
Ceratoscopelus warmingi	1	3.5409	0.339
Hygophum spp.	2	4.9102	0.470
Lepidophanes spp.	10	30.7544	2.941
Benthoosema suborbitale	2	5.5938	0.535
Chlorophthalmidae			
Chlorophthalmus agassizi	1	3.2296	0.309
Anguilliformes	14	22.2647	2.1292
Muraenidae	4	4.1837	0.400
Gymnothorax nigromarginatus	9	10.8882	1.041
Anarchias yoshiae	2	4.1059	0.393
Nettastomidae	1	0.3474	0.033
Hoplunnis diomedianus	2	1.8502	0.177
Congridae	3	4.0385	0.386
Ariosoma balearicum	2	4.3802	0.419

Table 13. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Hildebrandia gracilior	1	3.5409	0.339
Ophichthidae	14	16.9283	1.619
Ophichthus spp.	10	10.2344	0.979
Exocoetidae	1	0.3992	0.038
Parexocoetus brachypterus	3	2.5836	0.247
Cypselurus spp.	2	3.8512	0.368
Prognichthys gibbifrons	1	1.8092	0.173
Bregmacerotidae			
Bregmaceros atlanticus	10	27.1952	2.600
Bregmaceros Type A	126	366.6907	35.060
Bregmaceros Type B	101	176.3427	16.860
Bregmaceros macclellandi	1	2.0529	0.196
Syngnathidae			
Hippocampus erectus	1	0.0207	0.002
Syngnathus elucens	1	0.3149	0.030
Syngnathus pelagicus	1	1.5229	0.146
Syngnathus springeri	2	1.0826	0.104
Syngnathus scovelli	2	0.1281	0.012

Table 13. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Melamphaeidae			
Melamphaes spp.	1	3.5409	0.339
Holocentridae	1	1.4556	0.139
Mugilidae			
Mugil spp.	2	1.7153	0.164
Sphyraenidae			
Sphyraena spp.	1	1.8092	0.173
Sphyraena barracuda	6	15.2991	1.463
Serranidae	90	36.4416	3.484
Diplectrum formosum	218	142.2927	13.605
Epinephelus spp.	24	38.6798	3.698
Centropristis striata	1	0.3992	0.038
Hemanthias vivanus	6	13.1220	1.255
Serraniculus pumilio	152	48.1961	4.608
Liopropoma spp.	2	4.1059	0.393
Rypticus spp.	68	32.7481	3.131
Rypticus saponaceus	1	0.1831	0.018

Table 13. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Priacanthidae	27	60.4279	5.778
Pseudopriacanthus altus	1	0.6815	0.065
Apogonidae	248	167.0090	15.968
Branchiostegidae			
Caulolatilus cyanops	1	1.8092	0.173
Carangidae			
Chloroscombrus chrysurus	136	32.7290	3.129
Decapterus punctatus	581	578.0261	55.266
Seriola spp.	3	3.6593	0.350
Lutjanidae	253	258.2800	24.695
Pristipomoides aquilonaris	13	31.7112	3.032
Rhomboplites aurorubens	1	0.4297	0.041
Acanthuridae			
Acanthurus spp.	3	6.1588	0.589
Gerreidae	239	113.6930	10.870
Pomadasyidae	49	26.5909	2.542
Sciaenidae	2	0.9126	0.087
Cynoscion nebulosus	1	0.0207	0.002

Table 13. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Sparidae	1	1.9277	0.184
Chaetodontidae	3	4.2889	0.410
Pomacentridae	34	39.8119	3.807
Labridae	162	202.5500	19.366
Scaridae	61	85.2411	8.150
Opistognathidae	6	2.9788	0.285
Blenniidae	12	6.6111	0.632
Clinidae	17	15.9451	1.525
Ophidiidae	413	235.4780	22.514
Carapidae			
Carapus bermudensis	3	7.3921	0.707
Echiodon sp.	12	33.6570	3.218
Callionymidae	264	103.2080	9.868
Scombridae	5	6.6186	0.633
Auxis sp.	32	60.7573	5.809
Euthynnus alletteratus	30	49.8512	4.766
Katsuwonus pelamis	1	2.8573	0.273
Thunnus atlanticus	18	50.2049	4.800

Table 13. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Scomberomorus cavalla</i>	1	1.4004	0.134
<i>Scomberomorus maculatus</i>	12	4.7231	0.452
<i>Acanthocybium solanderi</i>	1	2.8573	0.273
Gempylidae	1	2.0529	0.196
Istiophoridae	1	2.8573	0.273
Stromateidae	4	0.8466	0.081
<i>Peprilus paru</i>	10	2.8400	0.272
Nomeidae			
<i>Cubiceps pauciradiatus</i>	1	1.4556	0.139
<i>Psenes pellucidus</i>	2	4.1059	0.393
Gobiidae	1,631	1,500.5400	143.469
Scorpaenidae	208	245.3890	23.462
Triglidae	83	49.3282	4.716
Bothidae	7	5.2375	0.501
<i>Citharichthys cornutus</i>	9	27.7664	2.655
<i>Citharichthys macrops</i>	55	23.3254	2.234
<i>Citharichthys gymnorhinus</i>	4	7.4860	0.716

Table 13. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
<i>Cyclopsetta fimbriata</i>	11	9.8011	0.937
<i>Etropus rimosus</i>	8	4.3048	0.412
<i>Syacium papillosum</i>	352	574.0030	54.881
<i>Monolene sessilicauda</i>	1	3.5409	0.339
<i>Bothus robinsi</i>	172	256.0580	24.482
Soleidae			
<i>Achirus lineatus</i>	2	0.3212	0.031
Cynoglossidae			
<i>Symphurus</i> spp.	100	56.6090	5.413
Balistidae	190	148.8260	14.230
Tetraodontidae	29	21.5280	2.058
Lophiiformes	89	125.2542	11.976
Unidentified Larvae	284	358.3463	34.262
Total Larvae	10,872	9,300.3952	889.224
NUMBER OF FAMILIES:	55		
NUMBER OF SPECIES:	64		

Table 14. Cruise IS 7209. Numbers of larvae, estimated total abundance in the area represented by the cruise ($149.80 \times 10^9 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Elopidae			
Elops saurus	1	0.2848	0.019
Clupeidae			
Etrumeus teres	15	26.9938	1.802
Harengula jaguana	2	3.5917	0.240
Sardinella anchovia	8	13.1863	0.880
Engraulidae	10	4.7229	0.315
Argentinidae			
Argentina spp.	2	3.4537	0.231
Nansenia spp.	1	1.7959	0.120
Gonostomatidae	8	18.3686	1.226
Cyclothone spp.	20	34.1016	2.277
Gonostoma elongatum	1	50.6871	3.384
Maurolicus muelleri	38	66.8160	4.460
Polymetme (?) Type I	4	7.7462	0.517
Vinciguerrria spp.	1	1.6657	0.111
Vinciguerrria nimbaria	1	1.6670	0.111

Table 14. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Vinciguerrria poweriae	2	3.4441	0.230
Sternoptychidae			
Argyropelecus spp.	3	6.8784	0.459
Sternoptyx spp.	1	1.6657	0.111
Stomiatidae			
Stomias spp.	1	1.6670	0.111
Chauliodontidae			
Chauliodus spp.	2	4.4110	0.294
Melanostomiatidae	3	4.9823	0.333
Synodontidae	81	112.4073	7.504
Saurida brasiliensis	1	0.3651	0.024
Synodus foetens	1	0.3473	0.023
Evermannellidae	1	2.9439	0.197
Paralepididae	12	26.6303	1.778
Myctophidae	4	7.6900	0.513
Diaphus spp.	60	113.1696	7.555
Notolychnus valdiviae	12	22.3216	1.490
Lampadena luminosa	2	3.4768	0.232

Table 14. Continued.

Taxa	Number of larvae	Abundance (x 10 ⁹)	Mean Number under 10 m ²
Lampanyctus spp.	2	5.3074	0.354
Lampanyctus alatus	2	5.4363	0.363
Lampanyctus ater	1	1.6670	0.111
Lampanyctus cuprarius	1	2.7452	0.183
Myctophum spp.	1	1.6483	0.110
Myctophum nitidulum	14	24.6060	1.643
Myctophum selenops	4	8.6414	0.577
Ceratoscopelus warmingi	3	5.2715	0.352
Hygophum spp.	11	25.7763	1.721
Hygophum reinhardti	1	1.6657	0.111
Lepidophanes spp.	9	13.1665	0.879
Lobianchia gemellari	2	5.8877	0.393
Benthoosema suborbitale	15	32.6875	2.182
Diogenichthys atlanticus	7	14.1653	0.946
Anguilliformes	3	3.9209	0.262
Muraenidae			
Gymnothorax nigromarginatus	5	3.5962	0.240
Anarchias yoshiae	1	1.8233	0.122

Table 14. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Nettastomidae	3	6.2679	0.418
Hoplunnis diomedianus	2	3.6057	0.241
Congridae	4	8.0039	0.534
Hildebrandia gracilior	2	4.4720	0.299
Ophichthidae	11	14.2641	0.952
Ophichthus spp.	2	1.0509	0.070
Myrophis punctatus	3	3.3756	0.225
Hemiramphidae			
Hyporhamphus unifasciatus	2	0.4274	0.029
Hemiramphus balao	1	1.6483	0.110
Bregmacerotidae			
Bregmaceros atlanticus	2	3.4616	0.231
Bregmaceros Type A	169	340.5906	22.736
Bregmaceros Type B	227	331.3417	22.119
Bregmaceros maclellandi	1	2.7452	0.183
Syngnathidae			
Hippocampus erectus	4	0.7405	0.049
Syngnathus spp.	2	1.0694	0.071

Table 14. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Syngnathus elucens</i>	3	2.9013	0.194
<i>Syngnathus springeri</i>	20	6.8202	0.455
<i>Syngnathus scovelli</i>	3	0.6143	0.041
Melamphaeidae			
<i>Melamphaes</i> spp.	1	1.6483	0.110
Holocentridae	1	1.8233	0.122
Caproidae			
<i>Antigonia</i> spp.	1	2.7452	0.183
Serranidae	9	13.7803	0.920
<i>Diplectrum formosum</i>	7	4.1158	0.275
<i>Epinephelus</i> spp.	1	1.7439	0.116
<i>Serranus</i> spp.	2	6.3856	0.426
<i>Hemanthias vivanus</i>	12	34.4474	2.300
<i>Pronotogrammus aureorubens</i>	7	13.6916	0.914
<i>Serraniculus pumilio</i>	1	0.3651	0.024
<i>Anthias</i> Type 1	8	24.4235	1.630
<i>Anthias</i> Type 3	6	12.5455	0.838
Priacanthidae	9	13.3762	0.893

Table 14. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Apogonidae	49	37.2246	2.485
Carangidae			
Decapterus punctatus	131	109.6204	7.318
Seriola spp.	15	24.7429	1.652
Coryphaenidae			
Coryphaena hippurus	1	1.6483	0.110
Lutjanidae	60	59.7593	3.989
Lutjanus spp.	1	1.8099	0.121
Pristipomoides aquilonaris	3	4.8842	0.326
Rhomboplites aurorubens	8	11.7038	0.781
Symphysanodon typus	1	1.6483	0.110
Acanthuridae			
Acanthurus spp.	1	1.6670	0.111
Gerreidae	34	18.0928	1.208
Pomadasyidae	27	10.8928	0.727
Sciaenidae	2	0.5796	0.039
Leiostomus xanthurus	18	7.6715	0.512

Table 14. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Sparidae	8	9.2494	0.617
Lagodon rhomboides	5	5.7262	0.382
Mullidae	3	4.6588	0.311
Kyphosidae			
Kyphosus spp.	1	0.2540	0.017
Chaetodontidae	2	3.0796	0.206
Pomacentridae	25	27.4931	1.835
Labridae	24	42.4341	2.833
Scaridae	78	104.9861	7.008
Opistognathidae	5	6.0384	0.403
Blenniidae	37	17.3213	1.156
Clinidae	50	27.9170	1.864
Ophidiidae	258	140.8773	9.404
Carapidae			
Echiodon sp.	11	19.6527	1.312
Callionymidae	58	80.0249	5.342
Gempylidae	12	34.0820	2.275

Table 14. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Stromateidae			
<i>Peprilus burti</i>	1	1.5052	0.100
Nomeidae			
<i>Cubiceps pauciradiatus</i>	1	1.6657	0.111
Arionmidae			
<i>Arionma</i> spp.	1	1.7268	0.115
Gobiidae	1,292	1,282.4408	85.610
Scorpaenidae	115	71.5495	4.776
Triglidae	161	77.8408	5.198
Bothidae	14	7.0354	0.470
<i>Citharichthys cornutus</i>	15	39.0462	2.607
<i>Citharichthys macrops</i>	64	20.7756	1.387
<i>Citharichthys gymnorhinus</i>	33	75.3685	5.031
<i>Cyclopsetta fimbriata</i>	3	2.3349	0.156
<i>Etropus rimosus</i>	106	95.7710	6.393
<i>Syacium papillosum</i>	100	99.9294	6.671
<i>Bothus robinsi</i>	206	206.4729	13.783

Table 14. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Cynoglossidae			
Symphurus spp.	7	5.2902	0.353
Balistidae	99	75.1763	5.018
Tetraodontidae	34	36.1695	2.414
Gobiesocidae	1	0.9907	0.066
Lophiiformes	39	54.6636	3.649
Unidentified Larvae	347	394.7997	26.355
Total Larvae	4,511	4,985.2922	332.797
NUMBER OF FAMILIES:	58		
NUMBER OF SPECIES:	60		

Table 15. Cruise IS 7303. Numbers of larvae, estimated total abundance in the area represented by the cruise ($149.80 \times 10^9 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeiformes	5	10.5376	0.703
Clupeidae			
Brevoortia spp.	12	1.4331	0.096
Etrumeus teres	293	327.2924	21.849
Harengula jaguana	1	0.0791	0.005
Sardinella anchovia	2	1.2428	0.083
Engraulidae	27	16.6853	1.114
Argentinidae	1	2.6698	0.178
Bathylagidae	2	3.9563	0.264
Gonostomatidae	70	140.6143	9.387
Cyclothone spp.	22	38.4568	2.567
Diplophos spp.	1	1.7259	0.115
Gonostoma spp.	1	1.7370	0.116
Gonostoma elongatum	37	102.3180	6.830
Ichthyococcus ovatus	1	1.2866	0.087
Maurolicus muelleri	4	5.7778	0.386
Polymetme (?) Type I	2	3.2047	0.214

Table 15. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Vinciguerrria spp.	6	12.7097	0.848
Vinciguerrria nimbaria	7	10.1858	0.680
Vinciguerrria poweriae	6	13.3421	0.891
Vinciguerrria attenuata	6	13.1515	0.875
Sternoptychidae	10	26.6977	1.782
Argyropelecus spp.	7	19.0642	1.273
Sternoptyx spp.	5	15.4604	1.032
Stomiatidae			
Stomias spp.	3	4.1755	0.279
Chauliodontidae			
Chauliodus spp.	7	10.8081	0.722
Melanostomiatidae	1	1.7371	0.116
Synodontidae	224	265.0115	17.691
Saurida brasiliensis	1	1.6544	0.110
Aulopidae			
Aulopus nanai	1	2.6698	0.178
Scopelarchidae	1	1.2641	0.084
Evermannellidae	1	1.7370	0.116

Table 15. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Paralepididae	4	6.4759	0.432
Myctophidae	16	33.9807	2.268
Diaphus spp.	199	352.2229	23.513
Notolychnus valdiviae	12	18.0490	1.205
Lampanyctus spp.	20	33.8514	2.260
Lampanyctus ater	1	1.2866	0.086
Myctophum nitidulum	20	32.1061	2.143
Myctophum selenops	3	4.0409	0.270
Ceratoscopelus warmingi	8	17.2175	1.149
Hygophum spp.	17	25.1520	1.679
Hygophum reinhardti	5	8.2441	0.550
Centrobranchus nigroocellatus	3	4.8070	0.321
Lepidophanes spp.	17	28.7814	1.921
Notoscopelus caudispinosus	19	34.5669	2.308
Notoscopelus resplendens	3	8.7525	0.584
Benthosema suborbitale	33	65.3635	4.363
Diogenichthys atlanticus	20	45.4054	3.031

Table 15. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Anguilliformes	6	8.7541	0.584
Muraenidae	1	1.2871	0.086
Nettastomidae	7	8.8557	0.591
Hoplunnis diomedianus	4	6.3829	0.426
Congridae	3	10.4271	0.696
Gnathophis spp.	1	4.4283	0.296
Hildebrandia gracilior	2	3.2047	0.214
Ophichthidae	2	1.7860	0.119
Ophichthus spp.	5	3.5436	0.237
Myrophis punctatus	4	1.6266	0.109
Hemiramphidae			
Hyporhamphus unifasciatus	1	0.1019	0.007
Gadidae			
Urophycis spp.	13	9.7476	0.654
Bregmacerotidae			
Bregmaceros atlanticus	11	17.2316	1.150
Bregmaceros Type A	99	187.8694	12.541
Bregmaceros Type B	143	157.0504	10.484

Table 15. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Bregmaceros macclellandi	7	9.0060	0.601
Macrorhamphosidae			
Macrorhamphosus scolopax	1	1.5704	0.105
Syngnathidae			
Hippocampus erectus	3	2.4973	0.167
Syngnathus spp.	1	0.1721	0.012
Syngnathus springeri	8	3.2092	0.214
Melamphaeidae			
Melamphaes spp.	7	10.2860	0.687
Mugilidae			
Mugil spp.	49	124.6085	8.318
Serranidae	45	56.7855	3.791
Diplectrum formosum	78	55.3665	3.696
Epinephelus spp.	1	0.6214	0.042
Serranus spp.	110	98.8185	6.597
Centropristis striata	10	8.0170	0.535
Hemanthias vivanus	35	77.8383	5.196
Pronotogrammus aureorubens	7	14.6627	0.979

Table 15. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Anthias spp.	1	1.5586	0.104
Anthias Type 1	4	8.6470	0.577
Anthias Type 3	1	1.7371	0.116
Priacanthidae	1	1.6544	0.110
Priacanthus spp.	1	1.2641	0.084
Apogonidae	12	16.3601	1.092
Branchiostegidae	2	3.4629	0.231
Caulolatilus spp.	3	4.6994	0.314
Caulolatilus cyanops	1	1.7371	0.116
Carangidae			
Caranx spp.	1	1.0317	0.069
Decapterus punctatus	97	75.9254	5.069
Seriola spp.	1	2.6698	0.178
Trachurus lathami	51	64.8355	4.328
Bramidae	4	6.9805	0.466
Lutjanidae	2	2.5512	0.170
Rhomboplites aurorubens	1	1.5586	0.104

Table 15. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Acanthuridae			
Acanthurus spp.	1	1.7370	0.116
Gerreidae	6	6.0530	0.404
Pomadasyidae	18	17.7849	1.187
Orthopristis chrysoptera	75	12.6239	0.843
Sciaenidae	4	3.0162	0.201
Leiostomus xanthurus	23	9.7961	0.654
Micropogon undulatus	1	0.4312	0.029
Sparidae	121	121.1697	8.089
Diplodus holbrooki	13	1.3247	0.088
Lagodon rhomboides	113	63.0293	4.208
Pagrus pagrus	1	1.0317	0.069
Archosargus probatocephalus	1	0.1506	0.010
Mullidae	19	24.8787	1.661
Kyphosidae			
Kyphosus spp.	1	1.2641	0.084
Chaetodontidae	2	3.0241	0.202

Table 15. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Labridae	28	24.0745	1.607
Scaridae	18	23.1325	1.544
Opistognathidae	1	1.3008	0.087
Blenniidae	19	11.4093	0.762
Clinidae	1	1.0317	0.069
Ophidiidae	130	118.7107	7.925
Carapidae			
Echiodon sp.	9	12.1314	0.810
Callionymidae	22	33.8643	2.261
Scombridae			
Auxis sp.	1	1.9460	0.130
Scomber japonicus	2	3.3089	0.221
Gemplyidae	6	10.8632	0.725
Nealotus tripes	1	1.2641	0.084
Trichiuridae			
Diplospinus multistriatus	1	1.2641	0.084
Stromateidae			
Peprilus burti	2	2.0633	0.138

Table 15. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Nomeidae			
<i>Cubiceps pauciradiatus</i>	2	2.2500	0.150
<i>Psenes pellucidus</i>	1	1.2871	0.086
Arionnidae			
<i>Arionna</i> spp.	17	35.7801	2.389
Gobiidae	603	527.5737	35.218
Scorpaenidae	5	6.8838	0.460
Triglidae	142	162.1076	10.822
Pleuronectiformes	1	0.2898	0.019
Bothidae	15	12.7978	0.854
<i>Citharichthys cornutus</i>	27	45.2853	3.023
<i>Citharichthys macrops</i>	38	21.3290	1.424
<i>Citharichthys gymnorhinus</i>	4	75.8631	5.064
<i>Cyclopsetta fimbriata</i>	1	1.2641	0.084
<i>Etropus rimosus</i>	336	168.5843	11.254
<i>Syacium papillosum</i>	72	49.6251	3.313
<i>Bothus robinsi</i>	79	80.5014	5.374
<i>Paralichthys</i> spp.	5	0.5006	0.033

Table 15. Continued.

Taxa		Number of larvae	Abundance (x 10 ⁹)	Mean Number under 10 m ²
Pleuronectidae		1	1.5587	0.104
Cynoglossidae				
Symphurus spp.		13	10.2375	0.683
Balistidae		32	33.3588	2.227
Tetraodontidae		43	55.5839	3.711
Lophiiformes		5	7.6759	0.512
Unidentified Larvae		506	704.4244	47.024
Total Larvae		4,642	5,311.8627	354.597
NUMBER OF FAMILIES:	64			
NUMBER OF SPECIES:	66			

Table 16. Cruise IS 7308. Numbers of larvae, estimated total abundance in the area represented by the cruise ($151.42 \times 10^3 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeiformes	7	16.0019	1.057
Clupeidae	50	13.8217	0.913
Brevoortia spp.	1	0.4890	0.032
Etrumeus teres	25	39.9253	2.637
Harengula jaguana	1,282	141.6722	9.356
Opisthonema oglinum	1,434	528.2082	34.884
Sardinella anchovia	797	424.0314	28.004
Engraulidae	205	92.4186	6.104
Argentinidae	1	3.6291	0.240
Argentina spp.	2	3.4694	0.229
Bathylagidae			
Bathylagus spp.	2	5.2188	0.345
Gonostomatidae	10	16.9682	1.121
Cyclothone spp.	39	110.4838	7.297
Gonostoma elongatum	9	18.4104	1.216
Maurolicus muelleri	98	199.7368	13.191

Table 16. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Vinciguerria spp.	1	3.6562	0.242
Vinciguerria nimbaria	5	15.8524	1.047
Vinciguerria poweriae	5	17.6052	1.163
Vinciguerria attenuata	4	7.9179	0.523
Sternoptychidae	2	3.4975	0.231
Argyropelecus spp.	8	13.9055	0.918
Sternoptyx spp.	5	12.4763	0.824
Stomiatidae			
Stomias affinis	1	4.4204	0.292
Chauliodontidae			
Chauliodus spp.	5	22.1022	1.460
Melanostomiatidae	3	6.8816	0.455
Synodontidae	153	190.9160	12.608
Scopelarchidae	1	1.7487	0.116
Paralepididae	12	29.2513	1.932
Myctophidae	28	72.9960	4.821
Diaphus spp.	147	402.0803	26.554

Table 16. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Notolychnus valdiviae</i>	24	70.3659	4.647
<i>Lampadena luminosa</i>	2	8.8409	0.584
<i>Lampanyctus alatus</i>	2	6.1551	0.407
<i>Lampanyctus cuprarius</i>	3	5.2462	0.347
<i>Myctophum</i> spp.	1	1.7487	0.116
<i>Myctophum nitidulum</i>	81	225.5809	14.898
<i>Myctophum obtusirostris</i>	1	4.4204	0.292
<i>Myctophum selenops</i>	3	10.8873	0.719
<i>Ceratoscopelus warmingi</i>	13	45.7426	3.021
<i>Hygophum</i> spp.	24	45.2004	2.985
<i>Hygophum reinhardti</i>	10	30.3522	2.004
<i>Centrobranchus nigroocellatus</i>	2	3.4975	0.231
<i>Lepidophanes</i> spp.	8	21.9487	1.450
<i>Lobianchia gemellari</i>	3	10.5896	0.699
<i>Benthosema suborbitale</i>	17	44.3032	2.926
<i>Diogenichthys atlanticus</i>	18	61.4332	4.057
Chlorophthalmidae			
<i>Chlorophthalmus agassizi</i>	1	1.5038	0.099

Table 16. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Anguilliformes	2	2.3426	0.155
Muraenidae	3	3.3963	0.224
Gymnothorax nigromarginatus	1	0.9567	0.063
Nettastomidae			
Hoplunnis diomedianus	2	4.1264	0.272
Congridae			
Ariosoma balearicum	1	1.5038	0.099
Hildebrandia gracilior	2	4.1264	0.272
Ophichthidae	5	6.6922	0.442
Hemiramphidae			
Hyporhamphus unifasciatus	2	0.2531	0.017
Hemiramphus brasiliensis	1	0.8970	0.059
Exocoetidae			
Prognichthys gibbifrons	3	3.7227	0.246
Bregmacerotidae			
Bregmaceros atlanticus	23	55.1883	3.644
Bregmaceros Type A	75	134.4331	8.878

Table 16. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Bregmaceros Type B	130	288.9132	19.080
Bregmaceros macclellandi	4	10.5107	0.694
Macrouridae	1	1.5038	0.099
Syngnathidae			
Hippocampus erectus	1	0.1989	0.013
Syngnathus elucens	6	2.4569	0.162
Syngnathus springeri	1	0.1983	0.013
Syngnathus louisianae	1	0.0972	0.006
Syngnathus scovelli	1	0.0542	0.004
Melamphaeidae			
Melamphaes spp.	2	6.1692	0.407
Holocentridae	3	3.0163	0.199
Mugilidae			
Mugil spp.	35	18.0064	1.189
Sphyraenidae			
Sphyraena barracuda	1	0.5279	0.035
Serranidae	60	65.8290	4.347
Diplectrum formosum	675	342.3026	22.606

Table 16. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Epinephelus</i> spp.	22	18.2138	1.203
<i>Epinephelus morio</i>	4	6.3589	0.420
<i>Hemanthias</i> spp.	1	1.7487	0.116
<i>Hemanthias vivanus</i>	78	127.0088	8.388
<i>Pronotogrammus aureorubens</i>	5	7.5188	0.497
<i>Serraniculus pumilio</i>	15	6.0414	0.399
<i>Anthias</i> spp.	9	13.5339	0.894
<i>Anthias</i> Type 1	21	48.4318	3.198
<i>Anthias</i> Type 3	1	1.5038	0.099
<i>Rypticus</i> spp.	3	2.9186	0.193
<i>Pseudogramma gregoryi</i>	4	4.8521	0.320
Priacanthidae	2	2.4605	0.162
Apongonidae	234	188.9121	12.476
Branchiostegidae			
<i>Caulolatilus</i> spp.	2	5.2452	0.346
Carangidae			
<i>Caranx</i> spp.	2	3.2525	0.215
<i>Chloroscombrus chrysurus</i>	35	12.1222	0.801

Table 16. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
<i>Decapterus punctatus</i>	539	295.4831	19.514
<i>Seriola</i> spp.	2	1.9330	0.128
Coryphaenidae			
<i>Coryphaena</i> spp.	1	1.5038	0.099
Lutjanidae	131	85.0568	5.617
<i>Pristipomoides aquilonaris</i>	1	4.4204	0.292
<i>Symphysanodon typus</i>	1	1.5038	0.099
Gerreidae	273	123.7238	8.171
Pomadasyidae	379	150.0492	9.910
<i>Orthopristis chrysoptera</i>	12	2.9439	0.194
Sciaenidae	3	1.3990	0.092
<i>Cynoscion nebulosus</i>	8	0.8796	0.058
<i>Leiostomus xanthurus</i>	81	8.9951	0.594
<i>Menticirrhus americanus</i>	2	0.1945	0.013
Sparidae	63	31.7423	2.096
<i>Archosargus probatocephalus</i>	39	6.2522	0.413
Mullidae	15	22.0709	1.458
<i>Mullus auratus</i>	1	1.2258	0.081

Table 16. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Kyphosidae			
Kyphosus spp.	6	6.4444	0.426
Chaetodontidae	1	3.6291	0.240
Pomacentridae	18	21.2776	1.405
Labridae	256	155.3116	7.615
Scaridae	8	7.9548	0.525
Opistognathidae	55	33.1039	2.186
Blenniidae	316	88.1738	5.823
Clinidae	37	28.1439	1.859
Ophidiidae	311	159.0815	10.506
Carapidae			
Echiodon sp.	8	17.0471	1.126
Callionymidae	22	16.2644	1.074
Scombridae	11	17.7838	1.174
Auxis sp.	14	19.8357	1.310
Euthynnus alletteratus	3	4.9159	0.325
Katsuwonus pelamis	1	4.4204	0.292
Thunnus thynnus	41	112.5053	7.430

Table 16. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Gempylidae	1	3.6291	0.240
Trichiuridae			
Diplospinus multistriatus	3	9.6393	0.637
Istiophoridae			
Istiophorus platypterus	1	1.7487	0.116
Nomeidae			
Cubiceps pauciradiatus	27	96.1505	6.350
Psenes cyanophrys	6	12.3728	0.817
Ariommidae			
Ariomma spp.	6	9.2676	0.612
Gobiidae	2,539	1,590.6635	105.050
Microdesmidae			
Microdesmus spp.	21	10.1130	0.668
Scorpaenidae	140	161.9459	10.695
Triglidae	139	71.0596	4.693
Peristedion spp.	1	1.7347	0.115
Dactylopteridae			
Dactylopterus volitans	1	1.7347	0.115

Table 16. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Bothidae	14	6.3631	0.420
Citharichthys spp.	2	8.8409	0.584
Citharichthys cornutus	27	78.8845	5.210
Citharichthys macrops	73	37.9344	2.505
Citharichthys gymnorhinus	15	23.1980	1.532
Cyclopsetta fimbriata	8	7.2305	0.478
Etropus rimosus	44	43.5782	2.878
Syacium papillosum	162	195.0288	12.880
Monolene sessilicauda	3	6.7226	0.444
Bothus robinsi	204	265.3865	17.527
Soleidae			
Achirus spp.	1	0.0258	0.002
Achirus lineatus	1	0.0258	0.002
Cynoglossidae			
Symphurus spp.	22	14.6307	0.966
Balistidae	401	319.4250	21.0953
Tetraodontidae	115	99.7187	6.586

Table 16. Continued.

Taxa		Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Lophiiformes		6	7.5322	0.497
Unidentified Larvae		978	548.5188	36.225
Total Larvae		13,652	9,493.5334	626.967
NUMBER OF FAMILIES:	67			
NUMBER OF SPECIES:	78			

Table 17. Cruise IS 7311. Numbers of larvae, estimated total abundance in the area represented by the cruise ($156.50 \pm 10^9 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Elopidae			
Megalops atlantica	1	2.8719	0.184
Clupeidae	65	22.5689	1.442
Harengula jaguana	61	9.7261	0.622
Opisthonema oglinum	3,679	1,078.6853	68.926
Sardinella anchovia	413	320.0663	20.452
Engraulidae	204	227.2337	14.520
Argentinidae	1	1.6868	0.108
Argentina spp.	1	1.5637	0.100
Nansenia spp.	1	1.5637	0.100
Bathylagidae			
Bathylagus spp.	1	1.8913	0.121
Gonostomatidae	136	246.6270	15.759
Cyclothone spp.	31	60.4377	3.862
Gonostoma elongatum	9	15.9539	1.019
Maurolicus muelleri	296	572.1120	36.557
Valenciennellus tripunctulatus	1	1.7537	0.112

Table 17. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Bonapartia pedaliota	1	1.8913	0.121
Polymetme (?) Type I	1	1.7892	0.114
Vinciguerrria spp.	4	5.0876	0.325
Vinciguerrria nimbaria	21	65.4505	4.182
Vinciguerrria poweriae	18	23.6210	1.509
Vinciguerrria attenuata	3	3.8106	0.203
Sternoptychidae			
Argygropelecus spp.	9	34.9608	2.234
Sternoptyx spp.	3	4.8053	0.307
Chauliodontidae			
Chauliodus spp.	2	12.9847	0.830
Synodontidae	163	232.8934	14.881
Paralepididae	66	157.1190	10.040
Myctophidae	15	31.0731	1.986
Diaphus spp.	587	1,154.2700	73.755
Diaphus dumerili	1	1.7537	0.112
Notolychnus valdiviae	37	95.8191	6.123

Table 17. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Lampadena luminosa</i>	6	10.6753	0.682
<i>Lampanyctus alatus</i>	15	31.0731	1.986
<i>Lampanyctus cuprarius</i>	3	5.3675	0.343
<i>Myctophum nitidulum</i>	73	198.6675	12.699
<i>Myctophum selenops</i>	4	7.9991	0.511
<i>Ceratoscopelus warmingi</i>	6	10.9393	0.699
<i>Hygophum</i> spp.	15	28.4294	1.817
<i>Hygophum reinhardti</i>	6	10.9946	0.703
<i>Centrobranchus nigroocellatus</i>	7	12.9906	0.830
<i>Lepidophanes</i> spp.	7	17.2586	1.103
<i>Notoscopelus resplendens</i>	3	5.2966	0.338
<i>Lobianchia gemellari</i>	3	5.3320	0.341
<i>Benthosema suborbitale</i>	15	28.1169	1.797
<i>Diogenichthys atlanticus</i>	17	28.8923	1.846
Giganturidae			
<i>Gigantura vorax</i>	1	1.7537	0.112
Anguilliformes	4	8.5358	0.545
Muraenidae	5	3.6914	0.236

Table 17. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Nettastomidae	2	2.0532	0.131
Hoplunnis tenuis	1	2.8719	0.184
Congridae			
Ariosoma balearicum	7	14.1288	0.903
Hildebrandia flava	1	1.3503	0.086
Hildebrandia gracilior	3	5.0865	0.325
Ophichthidae	5	10.6168	0.678
Ophichthus spp.	2	3.8006	0.243
Hemiramphidae			
Hemiramphus brasiliensis	1	0.0970	0.006
Exocoetidae	1	0.3032	0.019
Parexocoetus brachypterus	3	1.7443	0.112
Prognichthys gibbifrons	6	18.3739	1.174
Bregmaceros atlanticus	17	34.0716	2.177
Bregmaceros Type A	14	29.5519	1.888
Bregmaceros Type B	68	96.8858	6.191
Syngnathidae			
Hippocampus erectus	1	0.3758	0.024

Table 17. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Syngnathus spp.	2	0.5721	0.037
Syngnathus elucens	3	1.2070	0.077
Melamphaeidae			
Melamphaes spp.	4	6.4569	0.412
Sphyraenidae			
Sphyraena borealis	1	1.1055	0.071
Serranidae	91	56.5205	3.612
Diplectrum formosum	93	37.5988	2.403
Epinephelus spp.	4	3.6005	0.230
Hemanthias vivanus	2	2.7005	0.173
Serraniculus pumilio	26	12.2829	0.785
Liopropoma spp.	3	4.4366	0.284
Anthias Type 1	1	1.7892	0.114
Rypticus spp.	13	8.6750	0.554
Pseudogramma gregoryi	9	11.8758	0.759
Priacanthidae	10	14.7611	0.943
Apogonidae	147	135.9477	8.687

Table 17. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Carangidae			
<i>Caranx</i> spp.	15	45.1948	2.888
<i>Chloroscombrus chrysurus</i>	69	13.5971	0.869
<i>Decapterus punctatus</i>	176	112.9175	7.215
<i>Oligoplites saurus</i>	3	0.5633	0.036
<i>Selene vomer</i>	1	1.3502	0.086
<i>Seriola</i> spp.	3	1.0959	0.070
<i>Vomer setapinnis</i>	1	2.1725	0.139
Coryphaenidae			
<i>Coryphaena</i> spp.	1	2.8719	0.184
Lutjanidae	249	168.4508	10.764
<i>Rhomboplites aurorubens</i>	4	2.5571	0.163
Gerreidae	115	40.3848	2.581
Pomadasyidae	104	29.8323	1.906
Sciaenidae	2	0.0694	0.004
<i>Bairdiella chrysura</i>	3	0.2286	0.015
Sparidae	1	0.5610	0.036

Table 17. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Kyphosidae			
Kyphosus spp.	1	0.2689	0.017
Chaetodontidae	6	8.1508	0.521
Pomacentridae	16	15.9699	1.020
Labridae	205	190.4320	12.168
Scaridae	13	17.1761	1.098
Opistognathidae	3	2.2635	0.145
Blenniidae	10	4.4053	0.282
Clinidae	3	2.8644	0.183
Ophidiidae	189	221.1037	14.128
Carapidae			
Carapus bermudensis	2	1.8351	0.117
Echiodon sp.	24	41.5963	2.658
Callionymidae	251	79.6953	5.092
Scombridae	4	8.0736	0.516
Auxis sp.	7	15.0218	0.960
Euthynnus alletteratus	43	67.6493	4.323

Table 17. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Thunnus atlanticus</i>	6	9.9783	0.638
<i>Scomberomorus</i> spp.	1	0.2398	0.015
<i>Scomberomorus cavalla</i>	3	2.9848	0.191
<i>Scomberomorus maculatus</i>	71	18.7273	1.197
Gempylidae	5	10.0952	0.645
Stromateidae			
<i>Peprilus burti</i>	1	1.3503	0.086
Nomeidae	3	1.2775	0.082
<i>Cubiceps pauciradiatus</i>	4	7.4632	0.477
Arionnidae			
<i>Arionna</i> spp.	6	11.9082	0.761
Gobiidae	1,291	1,365.7200	87.266
Scorpaenidae	116	124.3386	7.945
Triglidae	62	27.6471	1.767
Bothidae	1	0.5366	0.034
<i>Citharichthys cornutus</i>	17	26.4746	1.692
<i>Citharichthys macrops</i>	20	14.5840	0.932

Table 17. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
<i>Citharichthys gymnorhinus</i>	10	16.4881	1.0536
<i>Cyclopsetta fimbriata</i>	12	10.6584	0.681
<i>Etropus rimosus</i>	2	3.0235	0.193
<i>Syacium papillosum</i>	172	194.6120	12.435
<i>Engyophrys senta</i>	1	1.3503	0.086
<i>Bothus robinsi</i>	87	118.8408	7.594
Soleidae			
<i>Achirus lineatus</i>	2	0.1317	0.008
Cynoglossidae			
<i>Symphurus</i> spp.	29	10.5879	0.677
Balistidae	136	109.1826	6.977
Tetraodontidae	31	31.7577	2.029
Lophiiformes	40	43.7893	2.798
Unidentified Larvae	667	918.0455	58.661
Total Larvae	10,881	9,481.9121	605.873

Table 17. Continued.

Taxa	Number of larvae	Abundance (x 10 ⁹)	Mean Number under 10 m ²
NUMBER OF FAMILIES:	57		
NUMBER OF SPECIES:	70		

Table 18. Cruise IS 7313. Numbers of larvae, estimated total abundance in the area represented by the cruise ($153.18 \times 10^3 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeidae	103	30.5528	1.995
Harengula jaguana	580	166.8235	10.891
Opisthonema oglinum	527	94.8178	6.190
Sardinella anchovia	1,140	469.8157	30.671
Engraulidae	322	573.0606	37.411
Argentinidae			
Argentina spp.	5	10.9566	0.715
Bathylagidae			
Bathylagus spp.	1	1.8442	0.120
Gonostomatidae	2	8.6781	0.566
Cyclothone spp.	9	19.5612	1.277
Gonostoma atlanticum	2	8.7877	0.574
Gonostoma elongatum	7	33.9370	2.216
Maurolicus muelleri	340	837.4638	54.672
Vinciguerrria spp.	2	4.4538	0.291
Vinciguerrria nimbaria	13	29.9330	1.954
Vinciguerrria poweriae	6	18.2731	0.083

Table 18. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Vinciguerria attenuata	2	4.0258	0.263
Sternoptychidae	1	2.0917	0.137
Argyropelecus spp.	9	55.6600	3.634
Sternoptyx spp.	2	13.3921	0.874
Synodontidae	146	169.7471	11.082
Saurida brasiliensis	1	1.3043	0.085
Synodus foetens	1	0.0916	0.006
Scopelarchidae	4	9.1124	0.595
Paralepididae	25	69.1924	4.517
Myctophidae	4	8.8281	0.576
Diaphus spp.	201	486.0554	31.731
Notolychnus valdiviae	13	47.2945	3.088
Lampadena luminosa	2	3.7748	0.2464
Lampanyctus alatus	4	8.7888	0.5738
Myctophum nitidulum	19	45.3400	2.960
Myctophum selenops	1	3.4327	0.224
Ceratoscopelus warmingi	3	5.4314	0.355

Table 18. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Hygophum spp.	2	5.6397	0.368
Hygophum reinhardti	2	4.7376	0.309
Hygophum benoiti	1	6.6960	0.437
Centrobranchus nigroocellatus	1	2.2070	0.144
Lepidophanes spp.	2	3.8901	0.254
Lobianchia gemellari	1	2.5306	0.165
Benthoosema suborbitale	19	58.3663	3.810
Diogenichthys atlanticus	6	23.0755	1.506
Anguilliformes	19	17.5050	1.143
Muraenidae	6	6.7942	0.444
Gymnothorax nigromarginatus	3	2.7357	0.179
Nettastomidae	2	4.0512	0.264
Hoplunnis diomedianus	2	2.6540	0.173
Congridae	4	4.9767	0.325
Ariosoma balearicum	1	6.6960	0.437
Paraconger caudilimbatus	1	2.2070	0.144
Gnathophippidae	1	2.2070	0.144

Table 18. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Hildebrandia flava	2	13.3921	0.874
Hildebrandia gracilior	2	3.7483	0.245
Nystactichthys spp.	5	4.2758	0.279
Ophichthidae	12	12.2815	0.802
Ophichthus spp.	3	4.1106	0.268
Dysommidae	1	1.8442	0.120
Belonidae	1	0.1607	0.010
Hemiramphidae			
Hyporhamphus unifasciatus	8	1.4192	0.093
Hemiramphus balao	1	0.1607	0.010
Exocoetidae	1	0.1377	0.009
Parexocoetus brachypterus	2	0.9841	0.064
Prognichthys gibbifrons	1	6.6960	0.437
Bregmacerotidae			
Bregmaceros atlanticus	15	43.9432	2.869
Bregmaceros Type A	1	1.3043	0.085
Bregmaceros Type B	205	338.9609	22.128
Macrouridae	1	1.8442	0.120

Table 18. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Syngnathidae			
<i>Syngnathus elucens</i>	3	1.4455	0.094
<i>Syngnathus scovelli</i>	2	0.3214	0.021
Holocentridae	4	4.7737	0.312
Mugilidae			
<i>Mugil</i> spp.	1	1.0275	0.067
Serranidae	60	19.2910	1.259
<i>Diplectrum formosum</i>	78	47.1286	3.077
<i>Epinephelus</i> spp.	1	0.6542	0.043
<i>Serranus</i> spp.	13	17.4625	1.140
<i>Serraniculus pumilio</i>	49	20.4359	1.334
<i>Liopropoma</i> spp.	5	13.7707	0.899
<i>Rypticus</i> spp.	34	26.2048	1.711
Priacanthidae	25	26.3347	1.719
<i>Pseudopriacanthus altus</i>	3	3.3510	0.219
Apogonidae	270	214.0514	13.974
Branchiostegidae			
<i>Caulolatilus</i> spp.	1	1.4363	0.094

Table 18. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Carangidae			
Caranx spp.	21	39.7296	2.594
Chloroscombrus chrysurus	196	52.3534	3.418
Decapterus punctatus	254	140.5420	9.175
Oligoplites saurus	6	1.6092	0.105
Selene vomer	1	2.0917	0.137
Seriola spp.	1	1.2177	0.080
Trachinotus spp.	1	0.3116	0.020
Lutjanidae	343	252.4043	16.478
Pristipomoides aquilonaris	2	2.8727	0.188
Rhomboplites aurorubens	1	1.3043	0.085
Gerreidae	157	65.9685	4.307
Pomadasyidae	138	51.0713	3.334
Sciaenidae	4	0.7338	0.048
Cynoscion arenarius	4	0.8295	0.054
Menticirrhus saxatilis	6	0.5496	0.036
Sparidae	1	0.7274	0.048

Table 18. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Mullidae	2	2.9332	0.192
Chaetodontidae	2	3.0205	0.197
Pomacentridae	11	7.7385	0.505
Labridae	231	210.3111	13.730
Scaridae	49	57.9209	3.781
Blenniidae	29	7.9104	0.516
Clinidae	17	13.7409	0.897
Ophidiidae	89	89.1370	5.819
Carapidae	1	1.8306	0.120
Echiodon sp.	15	24.0885	1.573
Callionymidae	250	87.3465	5.702
Scombridae	8	11.4828	0.750
Auxis sp.	30	61.8761	4.235
Euthynnus alletteratus	58	100.2041	6.542
Thunnus atlanticus	20	40.0223	2.613
Scomberomorus maculatus	9	2.1400	0.140

Table 18. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Gempylidae	3	5.4740	0.357
Stromateidae			
Peprilus paru	13	3.3029	0.216
Nomeidae			
Cubiceps pauciradiatus	1	2.2070	0.144
Psenes spp.	3	6.6211	0.432
Ariommidae			
Ariomma spp.	3	6.7140	0.438
Gobiidae	1,889	1,846.2472	120.528
Scorpaenidae	116	138.0947	9.015
Triglidae	89	35.6825	2.330
Bothidae	7	7.0529	0.460
Citharichthys cornutus	10	15.9958	1.044
Citharichthys macrops	15	6.3624	0.415
Citharichthys gymnorhinus	14	24.9288	1.627
Cyclopsetta fimbriata	8	8.1309	0.531
Etropus rimosus	2	3.0483	0.199
Syacium papillosum	310	373.0274	24.352

Table 18. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Engyophrys senta	2	3.0051	0.196
Bothus robinsi	156	204.3003	13.337
Soleidae			
Achirus lineatus	3	0.7580	0.050
Cynoglossidae			
Symphurus spp.	42	15.1243	0.987
Balistidae	111	70.6745	4.614
Tetraodontidae	25	33.1790	2.166
Lophiiformes	40	57.4405	3.750
Unidentified Larvae	1,220	1,294.1816	84.488
Total Larvae	10,419	9,370.0147	635.201
NUMBER OF FAMILIES: 57			
NUMBER OF SPECIES: 65			

Table 19. Cruise IS 7320. Numbers of larvae, estimated total abundance in the area represented by the cruises ($153.89 \times 10^9 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeiformes	4	9.0687	0.589
Clupeidae	1	0.8235	0.054
Brevoortia spp.	4	0.8823	0.057
Etrumeus teres	21	26.0960	1.696
Sardinella anchovia	23	7.5236	0.489
Engraulidae	11	7.0351	0.457
Gonostomatidae	10	17.4012	1.131
Cyclothone spp.	19	40.9057	2.658
Gonostoma elongatum	25	52.1262	3.387
Maurolicus muelleri	22	41.4453	2.693
Vinciguerrria spp.	2	4.4031	0.286
Vinciguerrria nimbaria	8	18.9065	1.229
Vinciguerrria poweriae	12	25.7835	1.675
Vinciguerrria attenuata	1	1.9601	0.127
Sternoptychidae			
Argyropelecus spp.	5	13.0181	0.846

Table 19. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Sternoptyx	5	12.4016	0.806
Stomiatidae			
Stomias spp.	1	1.7916	0.116
Melanostomiatidae	13	22.1701	1.441
Synodontidae	219	323.5051	21.022
Scopelarchidae	12	30.3574	1.973
Paralepididae	9	17.1591	1.115
Myctophidae	11	24.0840	1.565
Diaphus spp.	45	83.0560	5.397
Notolychnus valdiviae	37	69.7904	4.535
Lampanyctus spp.	2	3.6581	0.238
Lampanyctus alatus	5	10.5822	0.688
Myctophum nitidulum	5	12.4625	0.810
Myctophum obtusirostris	1	1.9528	0.127
Ceratoscopelus warmingi	12	27.2393	1.770
Hygophum spp.	22	46.9978	3.054
Hygophum reinhardti	3	5.2887	0.344
Centrobranchus nigroocellatus	3	4.2882	0.279

Table 19. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Lepidophanes spp.	15	27.5704	1.792
Lobianchia gemellari	1	1.2578	0.082
Benthoosema suborbitale	18	36.1398	2.348
Diogenichthys atlanticus	23	58.4322	3.797
Anguilliformes	9	12.6258	0.820
Muraenidae	2	1.7299	0.112
Gymnothorax nigromarginatus	4	3.6730	0.239
Nettastomidae	3	4.7303	0.307
Hoplunnis tenuis	1	1.2578	0.082
Congridae	1	1.2483	0.081
Ariosoma balearicum	2	2.5156	0.164
Uroconger syringinus	3	5.1192	0.333
Hildebrandia spp.	3	5.8584	0.381
Hildebrandia flava	7	18.2254	1.184
Hildebrandia gracilior	2	3.8614	0.251
Ophichthidae	12	16.8437	1.094
Ophichthus spp.	3	2.2214	0.144
Myrophis punctatus	8	11.8662	0.771

Table 19. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Belonidae	1	0.4936	0.032
Hemiramphidae			
Hyporhamphus unifasciatus	10	3.2378	0.210
Exocoetidae			
Parexocoetus brachypterus	2	3.7290	0.242
Gadidae			
Urophycis spp.	6	8.6887	0.565
Bregmacerotidae			
Bregmaceros atlanticus	5	10.2577	0.667
Bregmaceros Type A	4	6.5347	0.425
Bregmaceros Type B	451	651.2226	42.317
Bregmaceros macclellandi	2	2.5156	0.164
Syngnathidae			
Hippocampus erectus	10	3.5076	0.228
Syngnathus spp.	1	0.2858	0.019
Syngnathus elucens	3	0.8540	0.056
Syngnathus springeri	5	1.6693	0.109
Syngnathus scovelli	9	1.2079	0.079

Table 19. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Melamphaeidae			
Melamphaes spp.	1	1.2578	0.082
Holocentridae	1	1.2578	0.082
Caproidae			
Antigonia spp.	1	1.2578	0.082
Mugilidae			
Mugil spp.	8	13.6304	0.886
Atherinidae			
Menidia berrylina	1	0.5332	0.035
Serranidae	21	28.6705	1.863
Diplectrum formosum	37	25.0986	1.631
Serranus spp.	2	5.9365	0.386
Centropristis striata	7	1.1634	0.076
Hemanthias vivanus	1	2.6036	0.169
Serraniculus pumilio	3	1.1781	0.077
Plectranthias garrupellus	2	2.9215	0.190
Anthias Type 1	1	1.7916	0.116
Rypticus spp.	1	1.8164	0.118

Table 19. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Priacanthidae	8	13.8249	0.898
Apongonidae	62	42.6579	2.772
Branchiostegidae	3	3.7734	0.245
Carangidae			
<i>Caranx</i> spp.	1	1.7916	0.116
<i>Decapterus punctatus</i>	226	218.8237	14.220
<i>Trachurus lathami</i>	3	4.3320	0.282
Coryphaenidae			
<i>Coryphaena</i> spp.	1	2.6036	0.169
<i>Coryphaena hippurus</i>	3	5.1162	0.332
Lutjanidae	34	42.0018	2.729
<i>Pristipomoides aquilonaris</i>	4	6.7572	0.439
<i>Rhomboplites aurorubens</i>	1	1.2483	0.081
<i>Symphysanodon typus</i>	1	1.6656	0.108
Acanthuridae			
<i>Acanthurus</i> spp.	1	1.7916	0.116
Gerreidae	20	10.9443	0.711
Pomadasyidae	54	16.9884	1.104

Table 19. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Sciaenidae	1	1.2370	0.080
Cynoscion nebulosus	1	0.1617	0.011
Leiostomus xanthurus	5	1.1029	0.072
Micropogon undulatus	9	1.9286	0.125
Sparidae	16	13.9473	0.906
Mullidae	9	15.0992	0.981
Kyphosidae			
Kyphosus spp.	3	4.3012	0.280
Ephippidae	1	1.8645	0.121
Chaetodontidae	2	3.1223	0.203
Pomacentridae	55	63.7748	4.144
Labridae	29	44.1902	2.872
Scaridae	95	140.6166	9.138
Opistognathidae	1	1.8645	0.121
Blenniidae	38	9.8276	0.639
Clinidae	57	56.0024	3.639
Ophidiidae	276	220.8190	14.349

Table 19. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Carapidae	2	3.3312	0.216
Carapus bermudensis	1	1.7916	0.116
Echiodon sp.	68	110.2504	7.164
Callionymidae	102	66.1848	4.301
Scombridae			
Scomberomorus cavalla	2	2.4238	0.158
Gempylidae	5	13.0181	0.846
Gempylus serpens	1	4.1449	0.269
Nesiarchus nasutus	1	4.1449	0.269
Trichiuridae			
Diplospinus multistriatus	3	6.6604	0.433
Stromateidae			
Peprilus paru	1	1.2756	0.083
Peprilus burti	2	1.8228	0.118
Nomeidae			
Psenes spp.	1	1.2756	0.083
Psenes pellucidus	1	1.7916	0.116

Table 19.. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Gobiidae	919	1,034.7551	67.240
Scorpaenidae	165	227.4475	14.780
Triglidae	244	168.9612	10.979
Pleuronectiformes	4	4.0322	0.262
Bothidae			
<i>Citharichthys cornutus</i>	19	31.1891	2.027
<i>Citharichthys macrops</i>	33	13.8340	0.808
<i>Citharichthys gymnorhinus</i>	17	28.8006	1.872
<i>Cyclopsetta fimbriata</i>	7	8.3609	0.543
<i>Etropus rimosus</i>	76	47.2841	3.073
<i>Syacium papillosum</i>	229	272.6172	17.715
<i>Bothus robinsi</i>	196	256.8458	16.690
<i>Paralichthys</i> spp.	2	0.1314	0.008
Soleidae			
<i>Gymnachirus melas</i>	1	0.5332	0.035
Cynoglossidae			
<i>Symphurus</i> spp.	7	3.8404	0.250

Table 19. Continued.

Taxa		Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Balistidae		75	56.5013	3.672
Tetraodontidae		43	52.0149	3.380
Lophiiformes		44	57.2209	3.718
Unidentified Larvae		422	571.1095	37.112
Total Larvae		4,999	5,970.0656	387.944
NUMBER OF FAMILIES:	64			
NUMBER OF SPECIES:	67			

Table 20. Cruise CL 7405. Numbers of larvae, estimated total abundance in the area represented by the cruises ($52.00 \times 10^9 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeidae	24	0.8259	0.159
Brevoortia spp.	71	4.6812	0.900
Harengula jaguana	25	2.0233	0.389
Opisthonema oglinum	32	1.6192	0.311
Engraulidae	211	18.7803	3.612
Synodontidae	5	0.9856	0.190
Syngnathidae			
Hippocampus erectus	5	0.3092	0.060
Syngnathus spp.	3	0.0671	0.013
Syngnathus elucens	1	0.2514	0.048
Syngnathus springeri	1	0.2908	0.056
Syngnathus louisianae	4	0.1726	0.034
Syngnathus scovelli	6	0.1936	0.037
Atherinidae			
Menidia berrylina	1	0.1237	0.024
Sphyraenidae			
Sphyraena borealis	1	0.3045	0.059

Table 20. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Serranidae	8	1.8925	0.364
Diplectrum formosum	89	23.1829	4.458
Centropristis striata	58	6.8604	1.319
Apogonidae	6	1.4721	0.283
Gerreidae	11	1.7978	0.346
Pomadasyidae	16	4.3443	0.834
Orthopristis chrysoptera	331	31.8656	6.128
Sciaenidae	6	0.8178	0.157
Cynoscion arenarius	15	1.1974	0.230
Cynoscion nebulosus	1	0.0480	0.009
Leiostomus xanthurus	5	0.2782	0.054
Menticirrhus saxatilis	6	0.6639	0.128
Pogonias cromis	2	0.0959	0.018
Sparidae	60	8.0914	1.560
Diplodus holbrooki	98	11.9585	2.300
Lagodon rhomboides	38	6.9013	1.327
Archosargus probatocephalus	9	1.2563	0.242

Table 20. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Labridae	33	7.7973	1.500
Opistognathidae	13	2.7439	0.335
Blenniidae	245	38.7069	7.444
Clinidae	3	0.6036	0.116
Ophidiidae	65	12.1026	2.327
Callionymidae	37	6.9858	1.343
Gobiidae	249	47.3927	9.114
Scorpaenidae	1	0.2312	0.044
Triglidae	93	8.4435	1.624
Bothidae	19	4.1782	0.804
Citharichthys macrops	11	1.9746	0.380
Etropus rimosus	10	3.6939	0.710
Bothus robinsi	1	0.2312	0.044
Paralichthys spp.	5	0.6576	0.126
Cynoglossidae			
Symphurus spp.	8	0.7584	0.146
Balistidae	12	2.2961	0.442

Table 20. Continued.

Taxa		Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Tetraodontidae		16	3.2612	0.627
Gobiesocidae		7	0.3210	0.062
Unidentified Larvae		241	29.4619	5.666
Total Larvae		2,216	306.0260	58.851
NUMBER OF FAMILIES:	26			
NUMBER OF SPECIES:	23			

Table 21. Cruise CL 7412. Numbers of larvae, estimated total abundance in the area represented by the cruise ($91.33 \times 10^9 \text{ m}^2$), and estimated mean number under 10 m^2 of sea surface for larvae in each of the designated taxa.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Clupeidae	183	53.1284	5.817
Brevoortia spp.	1	0.0537	0.006
Etrumeus teres	57	50.8905	5.572
Harengula jaguana	1,429	132.0856	14.462
Opisthonema oglinum	1,421	281.5973	30.833
Sardinella anchovia	4,098	1,316.8873	144.190
Engraulidae	170	23.1638	2.533
Gonostomatidae			
Cyclothone spp.	1	0.8928	0.098
Synodontidae	77	44.2929	4.850
Myctophidae			
Diaphus spp.	6	3.9832	0.436
Anguilliformes	2	1.1905	0.130
Muraenidae	3	2.5609	0.280
Nettastomidae	1	0.8928	0.098
Ophichthidae	1	0.9586	0.105
Ophichthus spp.	1	0.5919	0.065

Table 21. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Belonidae	2	0.2369	0.026
Exocoetidae			
Cypselurus spp.	1	0.8928	0.098
Bregmacerotidae			
Bregmaceros Type B	40	45.1484	4.943
Fistulariidae			
Fistularia spp.	1	0.8928	0.098
Syngnathidae			
Hippocampus erectus	1	0.1302	0.014
Syngnathus spp.	1	0.7904	0.087
Syngnathus elucens	8	2.3378	0.256
Syngnathus springeri	3	1.3175	0.144
Syngnathus louisianae	6	0.5294	0.058
Syngnathus scovelli	26	0.7518	0.082
Mugilidae			
Mugil spp.	3	1.3164	0.144
Atherinidae			
Membras martinicus	4	0.1300	0.142

Table 21. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Sphyraenidae			
Sphyraena spp.	1	0.0820	0.009
Sphyraena borealis	3	2.2910	0.251
Serranidae	47	21.7230	2.378
Diplectrum formosum	472	202.8329	22.209
Epinephelus spp.	12	8.8873	0.973
Serranus spp.	2	1.3982	0.153
Hemanthias vivanus	1	0.8928	0.098
Serraniculus pumilio	29	6.7338	0.737
Liopropoma spp.	1	9.9586	0.105
Apogonidae	325	202.8329	22.209
Carangidae			
Chloroscombrus chrysurus	20	2.0124	0.220
Decapterus punctatus	563	219.4414	24.027
Oligoplites saurus	4	0.4757	0.052
Seriola spp.	1	0.1189	0.013
Lutjanidae	29	12.9643	1.420
Gerreidae	116	22.9909	2.517

Table 21. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m ²
Pomadasyidae	295	74.5848	8.167
Orthopristis chrysoptera	10	1.1535	0.126
Sciaenidae	11	1.1344	0.124
Cynoscion arenarius	2	0.1459	0.016
Cynoscion nebulosus	9	0.8440	0.092
Leiostomus xanthurus	13	0.7805	0.086
Menticirrhus saxatilis	12	1.5587	0.171
Sparidae	170	37.8555	4.145
Archosargus probatocephalus	1	0.1552	0.017
Mullidae	16	11.3314	1.241
Pomacentridae	55	28.3649	3.106
Labridae	333	120.8971	13.237
Scaridae	12	7.6904	0.842
Opistognathidae	144	50.9664	5.581
Blenniidae	213	47.8777	5.242
Clinidae	46	9.1328	1.000
Ophidiidae	372	178.2010	19.512

Table 21. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Carapidae			
Echiodon sp.	3	2.4951	0.273
Callionymidae	69	15.7334	1.723
Scombridae	1	0.8928	0.098
Thunnus thynnus	1	0.5952	0.065
Gobiidae	3,439	1,243.0859	136.109
Microdesmidae			
Microdesmus spp.	5	0.5741	0.063
Scorpaenidae	137	111.6603	12.226
Triglidae	203	50.2689	5.504
Bothidae	30	6.7229	0.736
Citharichthys macrops	57	9.0622	0.992
Cyclopsetta fimbriata	4	1.8054	0.198
Etropus rimosus	30	29.6788	3.250
Syacium papillosum	60	46.1068	5.048
Bothus robinsi	34	29.0781	3.184
Soleidae			
Achirus lineatus	13	2.2217	0.243

Table 21. Continued.

Taxa	Number of larvae	Abundance ($\times 10^9$)	Mean Number under 10 m^2
Gymnachirus melas	3	1.1336	0.124
Cynoglossidae			
Symphurus spp.	101	31.0073	3.395
Balistidae	575	157.7398	17.271
Tetraodontidae	135	61.1013	6.690
Gobiesocidae	2	0.2756	0.030
Lophiiformes	16	11.6042	1.271
Unidentified Larvae	1,049	262.3692	28.728
Total Larvae	16,854	5,281.6068	578.292
NUMBER OF FAMILIES:	44		
NUMBER OF SPECIES:	32		

Table 22. Cruise GE 7101. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	<i>Sardinella anchovia</i>	1,373	-	-
2	<i>Diplectrum formosum</i>	384	2.1 - 12.0	3.1 - 4.0
3	<i>Etrumeus teres</i>	310	-	-
4	<i>Decapterus punctatus</i>	200	1.1 - 22.0	2.1 - 3.0
5	<i>Orthopristis chrysoptera</i>	187	1.1 - 7.0	3.1 - 4.0
6	<i>Citharichthys macrops</i>	119	2.1 - 15.0	4.1 - 5.0
7	<i>Bregmaceros</i> Type B	100	1.1 - 13.0	2.1 - 3.0
8	<i>Trachurus lathami</i>	72	1.1 - 8.0	2.1 - 3.0
9	<i>Bothus robinsi</i>	66	2.1 - 20.0	3.1 - 4.0
10	<i>Lagodon rhomboides</i>	59	2.1 - 13.0	4.1 - 5.0
11	<i>Syacium papillosum</i>	34	1.1 - 11.0	2.1 - 3.0
12	<i>Anthias</i> Type 1	25	2.1 - 5.0	2.1 - 3.0
13	<i>Notoscopelus caudispinosus</i>	24	2.1 - 15.0	3.1 - 4.0
14	<i>Anthias</i> Type 2	18	2.1 - 5.0	3.1 - 4.0
15	<i>Hemanthias vivanus</i>	15	2.1 - 5.0	2.1 - 3.0
16	<i>Citharichthys cornutus</i>	12	2.1 - 7.0	3.1 - 4.0
17	<i>Pronotogrammus aureorubens</i>	10	2.1 - 5.0	2.1 - 3.0
18	<i>Echiodon</i> sp.	9	3.1 - 46.0	3.1 - 4.0
19	<i>Sygnathus elucens</i>	8	7.1 - 20.0	-
20	<i>Sygnathus springeri</i>	7	12.1 - >50.0	-

Table 23. Cruise 8C 7113 - TI 7114. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	<i>Opisthonema oglinum</i>	1,213	1.1 - 23.0	4.1 - 5.0
2	<i>Diplectrum formosum</i>	1,170	1.1 - 13.0	2.1 - 3.0
3	<i>Etropus rimosus</i>	873	1.1 - 18.0	4.1 - 5.0
4	<i>Decapterus punctatus</i>	587	1.1 - 22.0	2.1 - 3.0
5	<i>Archosargus probatocephalus</i>	272	1.1 - 11.0	3.1 - 4.0
6	<i>Harengula jaguana</i>	243	3.1 - 13.0	5.1 - 6.0
7	<i>Bregmaceros</i> Type B	198	1.1 - 30.0	2.1 - 3.0
8	<i>Orthopristis chrysoptera</i>	149	2.1 - 9.0	5.1 - 6.0
9	<i>Bregmaceros</i> Type A	137	1.1 - 17.0	2.1 - 3.0
10	<i>Citharichthys cornutus</i>	132	2.1 - 22.0	4.1 - 5.0
11	<i>Hemanthias vivanus</i>	113	1.1 - 14.0	3.1 - 4.0
12	<i>Myctophum nitidulum</i>	106	2.1 - 14.0	3.1 - 4.0
13	<i>Etrumeus teres</i>	102	3.1 - 25.0	5.1 - 6.0
14	<i>Syacium papillosum</i>	102	1.1 - 11.0	2.1 - 3.0
15	<i>Maurolicus muelleri</i>	94	2.1 - 16.0	5.1 - 6.0
16	<i>Centropristis striata</i>	93	2.1 - 10.0	4.1 - 5.0
17	<i>Citharichthys macrops</i>	83	2.1 - 10.0	3.1 - 4.0
18	<i>Citharichthys gymnorhinus</i>	57	2.1 - 17.0	3.1 - 4.0
19	<i>Bothus robinsi</i>	54	2.1 - 24.0	4.1 - 5.0
20	<i>Ceratoscopelus warmingi</i>	50	2.1 - 17.0	5.1 - 6.0

Table 24. Cruise GE 7117. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	<i>Opisthonema oglinum</i>	182	3.1 - 15.0	7.0 - 8.0
2	<i>Syacium papillosum</i>	121	1.1 - 14.0	2.1 - 3.0
3	<i>Bregmaceros</i> Type B	107	1.1 - 7.0	2.1 - 3.0
4	<i>Citharichthys cornutus</i>	60	2.0 - 21.0	5.1 - 6.0
5	<i>Bothus robinsi</i>	51	2.1 - 19.0	3.1 - 4.0
6	<i>Maurolicus muelleri</i>	44	3.1 - 5.0	3.1 - 4.0
7	<i>Euthynnus alletteratus</i>	32	2.1 - 19.0	3.1 - 4.0
8	<i>Etropus rimosus</i>	28	2.1 - 10.0	3.1 - 4.0
9	<i>Decapterus punctatus</i>	24	1.1 - 4.0	2.1 - 3.0
10	<i>Thunnus atlanticus</i>	11	2.1 - 6.0	3.1 - 4.0
11	<i>Diplectrum formosum</i>	10	2.1 - 5.0	3.1 - 4.0
12	<i>Citharichthys gymnorhinus</i>	10	2.1 - 10.0	5.1 - 6.0
13	<i>Auxis</i> sp.	7	2.1 - 5.0	3.1 - 4.0
14	<i>Bregmaceros</i> Type A	6	1.1 - 6.0	3.1 - 4.0
15	<i>Gymnothorax nigromarginatus</i>	6	35.0 - >50.0	-
16	<i>Hemanthias vivanus</i>	5	1.1 - 4.0	1.1 - 3.0
17	<i>Megalops atlantica</i>	4	5.1 - 10.0	-
18	<i>Parexocoetus brachypterus</i>	4	2.1 - 3.0	-
19	<i>Myctophum nitidulum</i>	3	2.1 - 6.0	-
	<i>Ceratoscopelus warmingi</i>	3	3.1 - 8.0	-
	<i>Serraniculus pumilio</i>	3	2.1 - 7.0	-
	<i>Echiodon</i> sp.	3	4.1 - 14.0	4.1 - 5.0

Table 25. Cruise 8C 7120 - TI 7121. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	<i>Syacium papillosum</i>	1,359	1.1 - 19.0	3.1 - 4.0
2	<i>Opisthonema oglinum</i>	1,101	2.1 - 17.0	5.1 - 6.0
3	<i>Bothus robinsi</i>	429	2.1 - 20.0	4.1 - 5.0
4	<i>Decapterus punctatus</i>	406	1.1 - 23.0	2.1 - 3.0
5	<i>Sardinella anchovia</i>	389	1.1 - 16.0	3.1 - 4.0
6	<i>Bregmaceros</i> Type B	370	1.1 - 21.0	2.1 - 3.0
7	<i>Chloroscombrus chrysurus</i>	312	1.1 - 13.0	2.1 - 3.0
8	<i>Diplectrum formosum</i>	199	1.1 - 11.0	2.1 - 3.0
9	<i>Citharichthys cornutus</i>	181	2.1 - 22.0	5.1 - 6.0
10	<i>Euthynnus alletteratus</i>	176	2.1 - 8.0	3.1 - 4.0
11	<i>Auxis</i> sp.	172	1.1 - 10.0	2.1 - 3.0
12	<i>Bregmaceros</i> Type A	169	1.1 - 8.0	2.1 - 3.0
13	<i>Myctophum nitidulum</i>	159	2.1 - 33.0	4.1 - 5.0
14	<i>Maurolicus muelleri</i>	131	3.1 - 28.0	6.1 - 7.0
15	<i>Thunnus atlanticus</i>	127	2.1 - 10.0	3.1 - 4.0
16	<i>Citharichthys gymnorhinus</i>	104	2.1 - 17.0	3.1 - 4.0
17	<i>Bregmaceros atlanticus</i>	74	1.1 - 26.0	2.1 - 3.0
18	<i>Echiodon</i> sp.	72	3.1 - >50.0	9.1 - 10.0
19	<i>Serraniculus pumilio</i>	56	2.1 - 7.0	2.1 - 3.0
20	<i>Cubiceps pauciradiatus</i>	53	1.1 - 5.0	2.1 - 3.0

Table 26. Cruise TI 7131 - 8B 7132. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	Bregmaceros Type B	335	1.1 - 21.0	2.1 - 3.0
2	Bothus robinsi	152	2.1 - 17.0	5.1 - 6.0
3	Decapterus punctatus	145	1.1 - >30.0	3.1 - 4.0
4	Etropus rimosus	133	2.1 - 12.0	3.1 - 4.0
5	Bregmaceros Type A	84	1.1 - 5.0	2.1 - 3.0
6	Etrumeus teres	72	3.1 - 15.0	4.1 - 5.0
7	Hemanthias vivanus	68	1.1 - 7.0	2.1 - 3.0
8	Syacium papillosum	62	2.1 - 17.0	6.1 - 7.0
9	Sardinella anchovia	55	2.1 - 30.0	5.1 - 6.0
10	Bregmaceros atlanticus	51	2.1 - 14.0	2.1 - 3.0
11	Gonostoma elongatum	24	5.1 - 19.0	8.1 - 9.0
12	Echiodon sp.	24	3.1 - 47.0	6.1 - 7.0
13	Benthoosema suborbitale	22	3.1 - 10.0	4.1 - 5.0
14	Notolychnus valdiviae	19	3.1 - 9.0	4.1 - 5.0
15	Diogenichthys atlanticus	18	2.1 - 7.0	3.1 - 4.0
16	Maurolicus muelleri	17	4.1 - 16.0	9.1 - 10.0
17	Citharichthys cornutus	17	3.1 - 12.0	3.1 - 4.0
18	Myctophum nitidulum	15	3.1 - 7.0	3.1 - 4.0
19	Anthias Type I	15	1.1 - 5.0	2.1 - 3.0
20	{ Vinciguerrria poweriae	14	7.1 - 20.0	10.1 - 11.0
	{ Diplectrum formosum	14	2.1 - 9.0	4.1 - 5.0

Table 27. Cruise 8B 7201 - GE 7202. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Range	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	<i>Etrumeus teres</i>	190	3.1 - 20.0	5.1 - 6.0
2	<i>Lagodon rhomboides</i>	120	2.1 - 10.0	3.1 - 4.0
3	<i>Etropus rimosus</i>	116	2.1 - 11.0	3.1 - 4.0
4	<i>Sardinella anchovia</i>	68	4.1 - 23.0	7.1 - 8.0
5	<i>Bregmaceros</i> Type B	60	1.1 - 15.0	2.1 - 3.0
6	<i>Syacium papillosum</i>	58	2.1 - 8.0	3.1 - 4.0
7	<i>Decapterus punctatus</i>	33	2.1 - 8.0	3.1 - 4.0
8	<i>Trachurus lathami</i>	33	2.1 - 6.0	2.1 - 3.0
9	<i>Citharichthys gymnorhinus</i>	21	3.1 - 13.0	4.1 - 5.0
10	<i>Bothus robinsi</i>	20	3.1 - 17.0	3.1 - 4.0
11	<i>Centropristis striata</i>	15	2.1 - 8.0	4.1 - 5.0
12	<i>Bregmaceros</i> Type A	14	1.1 - 7.0	1.1 - 2.0
13	<i>Diplectrum formosum</i>	14	1.1 - 8.0	3.1 - 4.0
14	<i>Maurolicus muelleri</i>	10	3.1 - 5.0	4.1 - 5.0
15	<i>Vinciguerrria nimbaria</i>	9	2.1 - 13.0	-
16	<i>Myctophum nitidulum</i>	7	3.1 - 10.0	3.1 - 4.0
17	<i>Citharichthys macrops</i>	7	3.1 - 8.0	4.1 - 5.0
18	<i>Hygophum reinhardti</i>	6	2.1 - 5.0	3.1 - 4.0
19	<i>Citharichthys cornutus</i>	6	4.1 - 15.0	4.1 - 5.0
20	<i>Bregmaceros atlanticus</i>	6	3.1 - 19.0	-

Table 28. Cruise GE 7208. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	<i>Opisthonema oglinum</i>	634	2.1 - 15.0	3.1 - 4.0
2	<i>Diplectrum formosum</i>	374	1.1 - 11.0	2.1 - 3.0
3	<i>Decapterus punctatus</i>	352	1.1 - 20.0	3.1 - 4.0
4	<i>Benthoosema suborbitale</i>	144	2.1 - 9.0	3.1 - 4.0
5	<i>Sardinella anchovia</i>	118	3.1 - 20.0	7.1 - 8.0
6	<i>Myctophum nitidulum</i>	104	1.1 - 9.0	3.1 - 4.0
7	<i>Syacium papillosum</i>	102	2.1 - 14.0	3.1 - 4.0
8	<i>Harengula jaguana</i>	95	3.1 - 14.0	7.1 - 8.0
9	<i>Thunnus thynnus</i>	77	2.1 - 9.0	2.1 - 3.0
10	<i>Citharichthys cornutus</i>	53	2.1 - 18.0	3.1 - 4.0
11	<i>Bregmaceros Type A</i>	52	2.1 - 21.0	2.1 - 3.0
12	<i>Hemanthias vivanus</i>	50	2.1 - 9.0	3.1 - 4.0
13	<i>Notolychnus valdiviae</i>	49	3.1 - 8.0	4.1 - 6.0
14	<i>Etropus rimosus</i>	47	2.1 - 10.0	3.1 - 4.0
15	<i>Bothus robinsi</i>	44	1.1 - 22.0	-
16	<i>Ceratoscopelus warmingi</i>	38	3.1 - 12.0	5.1 - 6.0
17	<i>Cynoscion nebulosus</i>	37	1.1 - 4.0	2.1 - 3.0
18	<i>Auxis sp.</i>	37	2.1 - 5.0	3.1 - 4.0
19	<i>Myctophum selenops</i>	35	2.1 - 6.0	3.1 - 4.0
20	<i>Diogenichthys atlanticus</i>	34	2.1 - 5.0	3.1 - 4.0

Table 29. Cruise GE 7210. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	<i>Opisthonema oglinum</i>	1,016	1.1 - 23.0	7.1 - 8.0
2	<i>Decapterus punctatus</i>	117	1.1 - 17.0	2.1 - 3.0
3	<i>Harengula jaguana</i>	110	1.1 - 14.0	3.1 - 4.0
4	<i>Sardinella anchovia</i>	94	3.1 - 9.0	4.1 - 5.0
5	<i>Diplectrum formosum</i>	51	2.1 - 11.0	2.1 - 3.0
6	<i>Membras martinicus</i>	37	4.1 - 7.0	5.1 - 6.0
7	<i>Syacium papillosum</i>	22	2.1 - 15.0	2.1 - 3.0
8	<i>Citharichthys macrops</i>	9	3.1 - 7.0	4.1 - 5.0
9	<i>Serraniculus pumilio</i>	6	2.1 - 4.0	3.1 - 4.0
10	<i>Euthynnus alletteratus</i>	5	2.1 - 6.0	4.1 - 5.0
11	<i>Gymnothorax nigromarginatus</i>	4	15.1 - >50.0	-
12	<i>Bothus robinsi</i>	4	4.1 - 13.0	-
13	<i>Auxis</i> sp.	3	2.1 - 5.0	-
14	<i>Etropus rimosus</i>	3	2.1 - 8.0	-
15	<i>Hyporhamphus unifasciatus</i>	2	5.1 - 7.0	-
16	<i>Syngnathus elucens</i>	2	11.1 - 18.0	-
17	<i>Syngnathus scovelli</i>	2	11.1 - >50.0	-
18	<i>Cyclopsetta fimbriata</i>	2	5.1 - 9.0	-
19	<i>Hemiramphus brasiliensis</i>	1	10.1 - 11.0	-
	<i>Hippocampus erectus</i>	1	7.1 - 8.0	-
	<i>Oligoplites saurus</i>	1	2.1 - 3.0	-
	<i>Rhomboplites aurorubens</i>	1	12.1 - 13.0	-
	<i>Gymnachirus melas</i>	1	3.1 - 4.0	-

Table 30. Cruise IS 7205. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	<i>Sardinella anchovia</i>	3,726	1.1 - 24.0	6.1 - 7.0
2	<i>Decapterus punctatus</i>	581	1.1 - 12.0	2.1 - 3.0
3	<i>Syacium papillosum</i>	352	1.1 - 15.0	2.1 - 3.0
4	<i>Diplectrum formosum</i>	218	1.1 - 8.0	2.1 - 3.0
5	<i>Bothus robinsi</i>	172	1.1 - 19.0	3.1 - 4.0
6	<i>Serraniculus pumilio</i>	152	1.1 - 8.0	2.1 - 3.0
7	<i>Chloroscombrus chrysurus</i>	136	1.1 - 12.0	2.1 - 3.0
8	<i>Bregmaceros Type A</i>	126	1.1 - 9.0	2.1 - 3.0
9	<i>Bregmaceros Type B</i>	101	1.1 - 26.0	2.1 - 3.0
10	<i>Opisthonema oglinum</i>	76	7.1 - 24.0	10.1 - 11.0
11	<i>Citharichthys macrops</i>	55	1.1 - 11.0	3.1 - 4.0
12	<i>Auxis</i> sp.	32	2.1 - 6.0	2.1 - 3.0
13	<i>Euthynnus alletteratus</i>	30	2.1 - 6.0	3.1 - 4.0
14	<i>Thunnus atlanticus</i>	18	2.1 - 8.0	3.1 - 4.0
15	<i>Pristipomoides aquilonaris</i>	13	4.1 - 10.0	4.1 - 5.0
16	<i>Echiodon</i> sp.	12	2.1 - 18.0	-
17	<i>Scomberomorus maculatus</i>	12	1.1 - 4.0	2.1 - 3.0
18	<i>Cyclopsetta fimbriata</i>	11	3.1 - 11.0	6.1 - 7.0
19	<i>Bregmaceros atlanticus</i>	10	2.1 - 8.0	2.1 - 3.0
20	<i>Peprilus paru</i>	10	1.1 - 4.0	2.1 - 3.0

Table 31. Cruise IS 7209. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	Bregmaceros Type B	227	1.1 - 35.0	2.1 - 3.0
2	Bothus robinsi	206	1.1 - 24.0	3.1 - 5.0
3	Bregmaceros Type A	169	1.1 - 8.0	1.1 - 2.0
4	Decapterus punctatus	131	1.1 - 11.0	2.1 - 3.0
5	Etropus rimosus	106	1.1 - 21.0	3.1 - 4.0
6	Syacium papillosum	100	1.1 - 16.0	2.1 - 3.0
7	Citharichthys macrops	64	2.1 - 16.0	3.1 - 4.0
8	Maurolicus muelleri	38	2.1 - 9.0	3.1 - 4.0
9	Citharichthys gymnorhinus	33	2.1 - 10.0	3.1 - 4.0
10	Gonostoma elongatum	20	4.1 - 14.0	4.1 - 5.0
11	Sygnathus springeri	20	9.1 - >50.0	-
12	Leiostomus xanthurus	18	1.1 - 4.0	2.1 - 3.0
13	Etrumeus teres	15	2.1 - 5.0	4.1 - 5.0
14	Benthoosema suborbitale	15	2.1 - 5.0	3.1 - 4.0
15	Citharichthys cornutus	15	2.1 - 10.0	2.1 - 3.0
16	Myctophum nitidulum	14	2.1 - 6.0	3.1 - 4.0
17	Notolychnus valdiviae	12	3.1 - 6.0	3.1 - 4.0
18	Hemanthias vivanus	12	2.1 - 5.0	2.1 - 3.0
19	Echiodon sp.	11	4.1 - 35.0	-
20	{ Sardinella anchovia	8	3.1 - 5.0	3.1 - 4.0
	{ Anthias Type 1	8	-	-
	{ Rhomboplites aurorubens	8	5.1 - 9.0	6.1 - 7.0

Table 32. Cruise IS 7303. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	<i>Etropus rimosus</i>	336	2.1 - 15.0	4.1 - 5.0
2	<i>Etrumeus teres</i>	293	2.1 - 30.0	4.1 - 5.0
3	<i>Bregmaceros</i> Type B	143	1.1 - 24.0	2.1 - 3.0
4	<i>Lagodon rhomboides</i>	113	2.1 - 12.0	5.1 - 6.0
5	<i>Bregmaceros</i> Type A	99	1.1 - 8.0	2.1 - 3.0
6	<i>Decapterus punctatus</i>	97	2.1 - 9.0	2.1 - 3.0
7	<i>Bothus robinsi</i>	79	3.1 - 23.0	4.1 - 5.0
8	<i>Diplectrum formosum</i>	78	2.1 - 8.0	2.1 - 3.0
9	<i>Orthopristis chrysoptera</i>	75	2.1 - 9.0	4.1 - 5.0
10	<i>Syacium papillosum</i>	72	1.1 - 10.0	2.1 - 3.0
11	<i>Trachurus lathami</i>	51	1.1 - 13.0	2.1 - 3.0
12	<i>Citharichthys gymnorhinus</i>	44	3.1 - 17.0	4.1 - 5.0
13	<i>Citharichthys macrops</i>	38	3.1 - 12.0	5.1 - 6.0
14	<i>Gonostoma elongatum</i>	37	3.1 - 12.0	4.1 - 5.0
15	<i>Hemanthias vivanus</i>	35	1.1 - 5.0	2.1 - 3.0
16	<i>Benthoosema suborbitale</i>	33	2.1 - 7.0	4.1 - 6.0
17	<i>Citharichthys cornutus</i>	27	3.1 - 17.0	3.1 - 4.0
18	<i>Leiostomus xanthurus</i>	23	3.1 - 10.0	4.1 - 5.0
19	<i>Myctophum nitidulum</i>	20	2.1 - 13.0	2.1 - 4.0
20	<i>Diogenichthys atlanticus</i>	20	3.1 - 8.0	3.1 - 4.0

Table 33. Cruise IS 7308. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	<i>Opisthonema oglinum</i>	1,434	2.1 - 22.0	3.1 - 4.0
2	<i>Harengula jaguana</i>	1,282	1.1 - 20.0	3.1 - 4.0
3	<i>Sardinella anchovia</i>	797	2.1 - 22.0	7.1 - 8.0
4	<i>Diplectrum formosum</i>	675	1.1 - 11.0	2.1 - 3.0
5	<i>Decapterus punctatus</i>	539	1.1 - 13.0	2.1 - 3.0
6	<i>Bothus robinasi</i>	204	2.1 - 16.0	3.1 - 4.0
7	<i>Syacium papillosum</i>	162	1.1 - 12.0	3.1 - 4.0
8	<i>Bregmaceros</i> Type B	130	1.1 - 27.0	2.1 - 3.0
9	<i>Maurolicus muelleri</i>	98	2.1 - 11.0	2.1 - 3.0
10	<i>Myctophum nitidulum</i>	81	2.1 - 9.0	4.1 - 5.0
11	<i>Leiostomus xanthurus</i>	81	1.1 - 10.0	2.1 - 3.0
12	<i>Hemanthias vivanus</i>	78	2.1 - 6.0	3.1 - 4.0
13	<i>Bregmaceros</i> Type A	75	1.1 - 4.0	2.1 - 3.0
14	<i>Citharichthys macrops</i>	73	2.1 - 14.0	3.1 - 4.0
15	<i>Etropus rimosus</i>	44	2.1 - 12.0	3.1 - 4.0
16	<i>Thunnus thynnus</i>	41	2.1 - 8.0	6.1 - 7.0
17	<i>Archosargus probatocephalus</i>	39	2.1 - 10.0	3.1 - 4.0
18	<i>Chloroscombrus chrysurus</i>	35	2.1 - 4.0	3.1 - 4.0
19	<i>Cubiceps pauciradiatus</i>	27	2.1 - 6.0	2.1 - 3.0
20	<i>Citharichthys cornutus</i>	27	2.1 - 16.0	4.1 - 5.0

Table 34. Cruise IS 7311. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	Opisthonema oglinum	3,679	2.1 - 17.0	3.1 - 4.0
2	Sardinella anchovia	413	2.1 - 30.0	3.1 - 4.0
3	Maurolicus muelleri	296	2.1 - 11.0	4.1 - 5.0
4	Decapterus punctatus	176	1.1 - 10.0	2.1 - 3.0
5	Syacium papillosum	172	2.1 - 12.0	3.1 - 4.0
6	Diplectrum formosum	93	1.1 - 16.0	2.1 - 3.0
7	Bothus robinsi	87	2.1 - 23.0	4.1 - 5.0
8	Myctophum nitidulum	73	2.1 - 15.0	3.1 - 4.0
9	Scomberomorus maculatus	71	1.1 - 8.0	3.1 - 4.0
10	Chloroscombrus chrysurus	69	1.1 - 4.0	2.1 - 3.0
11	Bregmaceros Type B	68	1.1 - 16.0	2.1 - 3.0
12	Harengula jaguana	61	1.1 - 30.0	1.1 - 2.0
13	Euthynnus alletteratus	43	1.1 - 8.0	3.1 - 4.0
14	Notolychnus valdiviae	37	2.1 - 20.0	3.1 - 4.0
15	Serraniculus pumilio	26	2.1 - 5.0	2.1 - 3.0
16	Echiodon sp.	24	3.1 - 26.0	8.1 - 9.0
17	Vinciguerria nimbaria	21	4.1 - 10.0	6.1 - 7.0
18	Citharichthys macrops	20	2.1 - 11.0	3.1 - 4.0
19	Vinciguerria poweriae	18	6.1 - 19.0	9.1 - 10.0
20	Bregmaceros atlanticus	17	1.1 - 12.0	3.1 - 4.0

Table 35. Cruise IS 7313. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	<i>Sardinella anchovia</i>	1,140	1.1 - 18.0	5.1 - 6.0
2	<i>Harengula jaguana</i>	580	1.1 - 17.0	2.1 - 3.0
3	<i>Opisthonema oglinum</i>	527	2.1 - 18.0	3.1 - 4.0
4	<i>Maurolicus muelleri</i>	340	2.1 - 8.0	2.1 - 3.0
5	<i>Syacium papillosum</i>	310	1.1 - 14.0	2.1 - 3.0
6	<i>Decapterus punctatus</i>	254	1.1 - 8.0	2.1 - 3.0
7	<i>Bregmaceros</i> Type B	205	1.1 - 9.0	2.1 - 3.0
8	<i>Chloroscombrus chrysurus</i>	196	1.1 - 24.0	2.1 - 3.0
9	<i>Bothus robinsi</i>	156	1.1 - 18.0	4.1 - 5.0
10	<i>Diplectrum formosum</i>	78	1.1 - 11.0	2.1 - 3.0
11	<i>Euthynnus alletteratus</i>	58	2.1 - 9.0	3.1 - 4.0
12	<i>Serraniculus pumilio</i>	49	1.1 - 5.0	2.1 - 3.0
13	<i>Auxis</i> sp.	30	2.1 - 7.0	2.1 - 3.0
14	<i>Thunnus atlanticus</i>	20	1.1 - 7.0	2.1 - 3.0
15	<i>Myctophum nitidulum</i>	19	2.1 - 10.0	3.1 - 4.0
16	<i>Benthoosema suborbitale</i>	19	2.1 - 9.0	4.1 - 5.0
17	<i>Bregmaceros atlanticus</i>	15	1.1 - 10.0	2.1 - 3.0
18	<i>Citharichthys macrops</i>	15	2.1 - 11.0	3.1 - 4.0
19	<i>Echiodon</i> sp.	15	3.1 - 46.0	-
20	<i>Citharichthys gymnorhinus</i>	14	3.1 - 13.0	4.1 - 5.0

Table 36. Cruise IS 7320. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	Bregmaceros Type B	451	1.1 - 21.0	2.1 - 3.0
2	Syacium papillosum	229	1.1 - 11.0	2.1 - 3.0
3	Decapterus punctatus	226	1.1 - 23.0	3.1 - 4.0
4	Bothus robinsi	196	1.1 - 26.0	4.1 - 5.0
5	Etropus rimosus	76	2.1 - 12.0	3.1 - 4.0
6	Echiodon sp.	68	2.1 - 39.0	6.1 - 8.0
7	Notolychnus valdiviae	37	2.1 - 9.0	3.1 - 4.0
8	Diplectrum formosum	37	1.1 - 12.0	3.1 - 4.0
9	Citharichthys macrops	33	2.1 - 17.0	3.1 - 4.0
10	Gonostoma elongatum	25	4.1 - 14.0	8.1 - 9.0
11	Sardinella anchovia	23	3.1 - 11.0	7.1 - 8.0
12	Diogenichthys atlanticus	23	2.1 - 8.0	3.1 - 4.0
13	Maurollicus muelleri	22	4.1 - 11.0	9.1 - 10.0
14	Etrumeus teres	21	3.1 - 8.0	4.1 - 5.0
15	Citharichthys cornutus	19	3.1 - 16.0	3.1 - 4.0
16	Benthoosema suborbitale	18	2.1 - 9.0	4.1 - 5.0
17	Citharichthys gymnorhinus	17	3.1 - 11.0	3.1 - 4.0
18	Vinciguerrria poweriae	12	5.1 - 11.0	7.1 - 8.0
19	Ceratoscopelus warmingi	12	3.1 - 10.0	3.1 - 4.0
20	{ Hyporhamphus unifasciatus	10	8.1 - 24.0	13.1 - 14.0
	{ Hippocampus erectus	10	5.1 - 23.0	-

Table 37. Cruise CL 7405. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	<i>Orthopristis chrysoptera</i>	331	1.6 - 9.0	5.1 - 6.0
2	<i>Diplodus holbrooki</i>	98	2.1 - 9.0	4.1 - 5.0
3	<i>Diplectrum formosum</i>	89	2.1 - 6.0	3.1 - 4.0
4	<i>Centropristis striata</i>	58	2.1 - 12.0	3.1 - 4.0
5	<i>Lagodon rhomboides</i>	38	2.1 - 12.0	5.1 - 6.0
6	<i>Opisthonema oglinum</i>	32	4.1 - 16.0	6.1 - 7.0
7	<i>Harengula jaguana</i>	25	4.1 - 15.0	6.1 - 7.0
8	<i>Cynoscion arenarius</i>	15	1.6 - 3.0	2.1 - 3.0
9	<i>Citharichthys macrops</i>	11	3.1 - 11.0	5.1 - 6.0
10	<i>Etropus rimosus</i>	10	2.1 - 6.0	-
11	<i>Archosargus probatocephalus</i>	9	2.1 - 8.0	2.1 - 3.0
12	<i>Syngnathus scovelli</i>	6	8.1 - 24.0	-
13	<i>Menticirrhus saxatilis</i>	6	1.1 - 3.0	2.1 - 3.0
14	<i>Hippocampus erectus</i>	5	6.1 - 31.0	6.1 - 7.0
15	<i>Leiostomus xanthurus</i>	5	2.1 - 5.0	3.1 - 5.0
16	<i>Syngnathus louisianae</i>	4	7.1 - 10.0	-
17	<i>Pogonias cromis</i>	2	2.1 - 3.0	2.1 - 3.0
18	<i>Syngnathus elucens</i>	1	18.1 - 19.0	-
	<i>Syngnathus springeri</i>	1	24.1 - 25.0	-
	<i>Menidia berylina</i>	1	40.1 - 41.0	-
	<i>Sphyræna borealis</i>	1	4.1 - 5.0	-
	<i>Cynoscion nebulosus</i>	1	2.1 - 3.0	-
20	<i>Bothus robinsi</i>	1	17.1 - 18.0	-

Table 38. Cruise CL 7412. Numbers of larvae, ranges of lengths and modal lengths of the 20 most observed species.

Rank	Species	Number of larvae	Length-range (mm)	Modal length (mm)
1	<i>Sardinella anchovia</i>	4,098	1.1 - 20.0	6.1 - 7.0
2	<i>Harengula jaguana</i>	1,429	1.1 - 19.0	2.1 - 3.0
3	<i>Opisthonema oglinum</i>	1,421	1.6 - 19.0	3.1 - 4.0
4	<i>Decapterus punctatus</i>	563	1.1 - 14.0	2.1 - 3.0
5	<i>Diplectrum formosum</i>	472	1.1 - 12.0	2.1 - 3.0
6	<i>Syacium papillosum</i>	60	2.1 - 7.0	3.1 - 4.0
7	<i>Etrumeus teres</i>	57	3.1 - 7.0	4.1 - 5.0
8	<i>Citharichthys macrops</i>	57	2.1 - 8.0	3.1 - 4.0
9	<i>Bregmaceros Type B</i>	40	1.1 - 18.0	2.1 - 3.0
10	<i>Bothus robinsi</i>	34	2.1 - 13.0	3.1 - 4.0
11	<i>Etropus rimosus</i>	30	2.1 - 9.0	3.1 - 4.0
12	<i>Serraniculus pumilio</i>	29	2.1 - 5.0	2.1 - 3.0
13	<i>Syngnathus scovelli</i>	26	11.1 - >50.0	13.1 - 14.0
14	<i>Chloroscombrus chrysurus</i>	20	2.1 - 5.0	2.1 - 3.0
15	<i>Leiostomus xanthurus</i>	13	1.1 - 4.0	2.1 - 3.0
16	<i>Achirus lineatus</i>	13	1.1 - 4.0	2.1 - 3.0
17	<i>Menticirrhus saxatilis</i>	12	1.1 - 4.0	2.1 - 3.0
18	<i>Orthopristis chrysoptera</i>	10	1.1 - 6.0	2.1 - 3.0
19	<i>Cynoscion nebulosus</i>	9	1.1 - 4.0	2.1 - 3.0
20	<i>Syngnathus elucens</i>	8	8.1 - 18.0	-

Table 39. The 20 most abundant species of larvae collected on 17 ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974. Abundance is expressed as the estimated mean number of larvae under 10 m² of sea surface.

Cruise GE 7101			Cruise 8C 7113 - TI 7114		
Rank	Species	Mean number under 10 m ²	Rank	Species	Mean number under 10 m ²
1	<i>Sardinella anchovia</i>	18.2445	1	<i>Diplectrum formosum</i>	29.7513
2	<i>Notoscopelus caudispinosus</i>	15.5936	2	<i>Opisthonema oglinum</i>	27.7739
3	<i>Etrumeus teres</i>	10.1175	1	<i>Etropus rimosus</i>	19.1827
4	<i>Maurollicus muelleri</i>	4.6723	1	<i>Decapterus punctatus</i>	13.3469
5	<i>Diplectrum formosum</i>	4.4230	5	<i>Bregmaceros Type B</i>	9.8498
6	<i>Decapterus punctatus</i>	3.9471	6	<i>Harengula jaguana</i>	6.7286
7	<i>Psenes pellucidus</i>	3.8936	7	<i>Archosargus probatocephalus</i>	6.5251
8	<i>Bregmaceros Type B</i>	3.6890	8	<i>Myctophum nitidulum</i>	3.8480
9	<i>Trachurus lathami</i>	3.4726	9	<i>Citharichthys cornutus</i>	3.4994
10	<i>Bothus robinsi</i>	3.1773	10	<i>Etrumeus teres</i>	3.4222
11	<i>Vinciguerrria nimbaria</i>	1.5977	11	<i>Bregmaceros Type A</i>	3.2997
12	<i>Citharichthys macrops</i>	1.0288	12	<i>Hemanthias vivanus</i>	3.2268
13	<i>Orthopristis chrysoptera</i>	0.9763	13	<i>Maurollicus muelleri</i>	2.9894
14	<i>Bregmaceros Type A</i>	0.9047	14	<i>Orthopristis chrysoptera</i>	2.8962
15	<i>Myctophum nitidulum</i>	0.8160	15	<i>Centropristis striatus</i>	2.2469
16	<i>Ceratoscopelus warmingi</i>	0.7971	16	<i>Syacium papillosum</i>	2.2258
17	<i>Benthoosema suborbitale</i>	0.7787	17	<i>Citharichthys macrops</i>	2.1786
18	<i>Nesiarchus nasutus</i>	0.7787	18	<i>Vinciguerrria poweriae</i>	1.4022
19	<i>Diplospinus multistriatus</i>	0.7787	19	<i>Ceratoscopelus warmingi</i>	1.2432
20	<i>Lagodon rhomboides</i>	0.6462	20	<i>Bothus robinsi</i>	1.0582

Table 39. Continued.

Cruise GE 7117			Cruise 8C 7120 - TI 7121		
Rank	Species	Mean number under 10 m ²	Rank	Species	Mean number under 10 m ²
1	Syacium papillosum	26.5467	1	Syacium papillosum	26.7731
2	Bregmaceros Type B	26.3138	2	Opisthonema oglinum	11.0763
3	Opisthonema oglinum	17.7578	3	Bothus robinsi	8.5898
4	Citharichthys cornutus	9.7428	4	Myctophum nitidulum	7.8292
5	Maurolicus muelleri	9.1244	5	Decapterus punctatus	6.5344
6	Thunnus atlanticus	6.3901	6	Auxis sp.	5.6533
7	Bothus robinsi	6.3128	7	Maurolicus muelleri	5.3653
8	Decapterus punctatus	4.7092	8	Bregmaceros Type B	5.2943
9	Euthynnus alletteratus	3.6436	9	Euthynnus alletteratus	5.1221
10	Etropus rimosus	2.7713	10	Chloroscombrus chrysurus	5.0535
11	Citharichthys gymnorhinus	2.0479	11	Thunnus atlanticus	4.2919
12	Gymnothorax nigromarginatus	1.5398	12	Sardinella anchovia	4.1964
13	Auxis sp.	1.1522	13	Citharichthys cornutus	4.0312
14	Pristipomoides aquilonaris	0.9842	14	Bregmaceros atlanticus	3.5980
15	Hemanthias vivanus	0.9099	15	Cubiceps pauciradiatus	3.3850
16	Bregmaceros Type A	0.8922	16	Diplectrum formosum	2.8658
17	Ceratoscopelus warmingi	0.8618	17	Bregmaceros Type A	2.4589
18	Diplectrum formosum	0.8446	18	Vinciguerrria nimbaria	2.2255
19	Serraniculus pumilio	0.7954	19	Notolychnus valdiviae	2.2156
20	Hygophum reinhardtii	0.5745	20	Gonostoma elongatum	1.8534

Table 39. Continued.

Cruise TI 7131 - 8B 7132			Cruise 8B 7201 - GE 7202		
Rank	Species	Mean number under 10 m ²	Rank	Species	Mean number under 10 m ²
1	Bregmaceros Type B	14.0161	1	Etrumeus teres	18.1360
2	Bothus robinsi	10.8640	2	Lagodon rhomboides	11.7282
3	Decapterus punctatus	8.3626	3	Etropus rimosus	11.6815
4	Etropus rimosus	6.9325	4	Bregmaceros Type B	6.0236
5	Etrumeus teres	4.0262	5	Sardinella anchovia	4.6712
6	Bregmaceros Type A	3.9859	6	Trachurus lathami	2.8235
7	Sardinella anchovia	3.9813	7	Syacium papillosum	2.5680
8	Hemanthias vivanus	3.0968	8	Citharichthys gymnorhinus	2.0398
9	Syacium papillosum	2.8634	9	Decapterus punctatus	1.8654
10	Bregmaceros atlanticus	2.7142	10	Diplectrum formosum	1.1770
11	Gonostoma elongatum	1.4122	11	Bregmaceros Type A	1.4745
12	Citharichthys cornutus	1.0994	12	Bothus robinsi	1.4618
13	Centropristis striata	1.0282	13	Maurolicus muelleri	1.3068
14	Diogenichthys atlanticus	1.0117	14	Myctophum nitidulum	1.2689
15	Maurolicus muelleri	0.9570	15	Centropristis striata	1.0450
16	Benthoosema suborbitale	0.9540	16	Citharichthys cornutus	1.0156
17	Myctophum nitidulum	0.9301	17	Hygophum reinhardti	0.9019
18	Citharichthys macrops	0.9089	18	Vinciguerrria nimbaria	0.7543
19	Hygophum reinhardti	0.8872	19	Bregmaceros atlanticus	0.7259
20	Hildebrandia gracilior	0.7910	20	Leiostomus xanthurus	0.6501

Table 39. Continued.

Cruise GE 7208			Cruise GE 7210		
Rank	Species	Mean number under 10 m ²	Rank	Species	Mean number under 10 m ²
1	Benthoosema suborbitale	29.6589	1	Opisthonema oglinum	172.8047
2	Decapterus punctatus	19.1133	2	Sardinella anchovia	20.4107
3	Myctophum nitidulum	18.0269	3	Decapterus punctatus	17.5116
4	Thunnus thynnus	17.2209	4	Harengula jaguana	6.0130
5	Opisthonema oglinum	16.4364	5	Diplectrum formosum	5.6944
6	Diplectrum formosum	15.5729	6	Syacium papillosum	3.6879
7	Notolychnus valdiviae	9.4769	7	Membras martinicus	1.7296
8	Bregmaceros Type A	8.8466	8	Bothus robinsi	0.8394
9	Citharichthys cornutus	7.6450	9	Citharichthys macrops	0.7758
10	Syacium papillosum	7.5394	10	Euthynnus alletteratus	0.7066
11	Myctophum selenops	6.8075	11	Etropus rimosus	0.6514
12	Diogenichthys atlanticus	6.3708	12	Serraniculus pumilio	0.5914
13	Sardinella anchovia	5.1289	13	Gymnothorax nigromarginatus	0.5722
14	Ceratoscopelus warmingi	5.0192	14	Auxis sp.	0.5523
15	Bregmaceros atlanticus	4.9433	15	Cyclopsetta fimbriata	0.4104
16	Bothus robinsi	4.2614	16	Syngnathus elucens	0.2506
17	Hemanthias vivanus	3.9253	17	Rhomboplites aurorubens	0.2156
18	Vinciguerrria nimbaria	3.6270	18	Gymnachirus melas	0.1344
19	Auxis sp.	3.5772	19	Hemiramphus brasiliensis	0.1235
20	Etropus rimosus	2.1778	20	Hyporhamphus unifasciatus	0.1167

Table 39. Continued.

Cruise IS 7205			Cruise IS 7209		
Rank	Species	Mean number under 10 m ²	Rank	Species	Mean number under 10 m ²
1	<i>Sardinella anchovia</i>	214.2940	1	<i>Bregmaceros</i> Type A	22.7364
2	<i>Decapterus punctatus</i>	55.2659	2	<i>Bregmaceros</i> Type B	22.1189
3	<i>Syacium papillosum</i>	54.8813	3	<i>Bothus robinsi</i>	13.7832
4	<i>Bregmaceros</i> Type A	35.0598	4	<i>Decapterus punctatus</i>	7.3178
5	<i>Bothus robinsi</i>	24.4821	5	<i>Syacium papillosum</i>	6.6709
6	<i>Bregmaceros</i> Type B	16.8604	6	<i>Etropus rimosus</i>	6.3933
7	<i>Diplectrum formosum</i>	13.6048	7	<i>Citharichthys gymnorhinus</i>	5.0313
8	<i>Auxis</i> sp.	5.8091	8	<i>Maurollicus muelleri</i>	4.4603
9	<i>Thunnus atlanticus</i>	4.8002	9	<i>Gonostoma elongatum</i>	3.3840
10	<i>Euthynnus alletteratus</i>	4.7663	10	<i>Citharichthys cornutus</i>	2.6606
11	<i>Serraniculus pumilio</i>	4.6081	11	<i>Benthoosema suborbitale</i>	2.1821
12	<i>Echiodon</i> sp.	3.2180	12	<i>Etrumeus teres</i>	1.8020
13	<i>Chloroscombrus chrysurus</i>	3.1285	13	<i>Myctophum nitidulum</i>	1.6426
14	<i>Pristipomoides aquilonaris</i>	3.0320	14	<i>Anthias</i> Type 1	1.6304
15	<i>Citharichthys cornutus</i>	2.6548	15	<i>Notolychnus valdiviae</i>	1.4901
16	<i>Bregmaceros atlanticus</i>	2.6002	16	<i>Citharichthys macrops</i>	1.3869
17	<i>Citharichthys macrops</i>	2.2340	17	<i>Echiodon</i> sp.	1.3119
18	<i>Sphyraena barracuda</i>	1.4628	18	<i>Diogenichthys atlanticus</i>	0.9456
19	<i>Vinciguerria nimbaria</i>	1.2775	19	<i>Pronotogrammus auroreus</i>	0.9140
20	<i>Hemanthias vivanus</i>	1.2546	20	<i>Anthias</i> Type 3	0.8375

Table 39. Continued.

Cruise IS 7303			Cruise IS 7308		
Rank	Species	Mean number under 10 m ²	Rank	Species	Mean number under 10 m ²
1	Etrumeus teres	21.8486	1	Opisthonema oglinum	34.8836
2	Bregmaceros Type A	12.5413	2	Sardinella anchovia	28.0037
3	Etropus rimosus	11.2540	3	Diplectrum formosum	22.6062
4	Bregmaceros Type B	10.4840	4	Decapterus punctatus	19.5141
5	Gonostoma elongatum	6.8303	5	Bregmaceros Type B	19.0800
6	Bothus robinsi	5.3739	6	Bothus robinsi	17.5265
7	Hemanthias vivanus	5.1961	7	Myctophum nitidulum	14.8977
8	Decapterus punctatus	5.0685	8	Maurolicus muelleri	13.1905
9	Citharichthys gymnorhinus	5.0643	9	Syacium papillosum	12.800
10	Benthoosema suborbitale	4.3634	10	Harengula jaguana	9.3562
11	Trachurus lathami	4.3281	11	Bregmaceros Type A	8.8782
12	Lagodon rhomboides	4.2076	12	Hemanthias vivanus	8.3878
13	Diplectrum formosum	3.6960	13	Thunnus thynnus	7.4300
14	Syacium papillosum	3.3128	14	Cubiceps pauciradiatus	6.3500
15	Diogenichthys atlanticus	3.0311	15	Citharichthys cornutus	5.2097
16	Citharichthys cornutus	3.0231	16	Notolychnus valdiviae	4.6471
17	Notoscopelus caudispinosus	2.3075	17	Diogenichthys atlanticus	4.0571
18	Myctophum nitidulum	2.1433	18	Bregmaceros atlanticus	3.6445
19	Citharichthys macrops	1.4238	19	Anthias Type I	3.1985
20	Notolychnus valdiviae	1.2049	20	Ceratoscopelus warmingi	3.0209

Table 39. Continued.

Cruise IS 7311			Cruise IS 7313		
Rank	Species	Mean number under 10 m ²	Rank	Species	Mean number under 10 m ²
1	Opisthonema oglinum	68.9256	1	Maurolicus muelleri	54.6719
2	Maurolicus muelleri	36.5567	2	Sardinella anchovia	30.6708
3	Sardinella anchovia	20.4515	3	Syacium papillosum	24.3522
4	Myctophum nitidulum	12.6994	4	Bregmaceros Type B	22.1283
5	Syacium papillosum	12.4353	5	Bothus robinsi	13.3373
6	Bothus robinsi	7.5937	6	Harengula jaguana	10.8907
7	Decapterus punctatus	7.2152	7	Decapterus punctatus	9.1750
8	Bregmaceros Type B	6.1908	8	Euthynnus alletteratus	6.5416
9	Notolychnus valdiviae	6.1226	9	Opisthonema oglinum	6.1900
10	Euthynnus alletteratus	4.3226	10	Auxis sp.	4.2353
11	Vinciguerrria nimbaria	4.1821	11	Benthoosema suborbitale	3.8103
12	Echiodon sp.	2.6579	12	Chloroscombrus chrysurus	3.4178
13	Diplectrum formosum	2.4025	13	Notolychnus valdiviae	3.0875
14	Bregmaceros atlanticus	2.1771	14	Diplectrum formosum	3.0767
15	Lampanyctus alatus	1.9855	15	Myctophum nitidulum	2.9599
16	Bregmaceros Type A	1.8883	16	Bregmaceros atlanticus	2.8687
17	Diogenichthys atlanticus	1.8462	17	Thunnus atlanticus	2.6128
18	Benthoosema suborbitale	1.7966	18	Vinciguerrria nimbaria	1.9541
19	Citharichthys cornutus	1.6917	19	Citharichthys gymnorhinus	1.6274
20	Vinciguerrria poweriae	1.5093	20	Diogenichthys atlanticus	1.5064

Table 39. Continued.

Cruise IS 7320			Cruise CL 7405		
Rank	Species	Mean number under 10 m ²	Rank	Species	Mean number under 10 m ²
1	Bregmaceros Type B	42.3174	1	Orthopristis chrysoptera	6.1280
2	Syacium papillosum	17.7151	2	Diplectrum formosum	4.4583
3	Bothus robindi	16.6902	3	Diplodus holbrooki	2.2997
4	Decapterus punctatus	14.2195	4	Lagodon rhomboides	1.3272
5	Echiodon sp.	7.1642	5	Centropristis striata	1.3193
6	Notolychnus valdiviae	4.5351	6	Etropus rimosus	0.7104
7	Diogenichthys atlanticus	3.7970	7	Harengula jaguana	0.3891
8	Gonostoma elongatum	3.3872	8	Citharichthys macrops	0.3797
9	Etropus rimosus	3.0726	9	Opisthonema oglinum	0.3114
10	Maurollicus muelleri	2.6932	10	Archosargus probatocephalus	0.2416
11	Benthoosema suborbitale	2.3484	11	Cynoscion arenarius	0.2303
12	Citharichthys cornutus	2.0267	12	Menticirrhus saxatilis	0.1277
13	Citharichthys gymnorhinus	1.8715	13	Hippocampus erectus	0.0595
14	Ceratoscopelus warmingi	1.7700	14	Sphyræna borealis	0.0586
15	Etrumeus teres	1.6958	15	Syngnathus springeri	0.0559
16	Vinciguerria poweriae	1.6754	16	Leiostomus xanthurus	0.0535
17	Diplectrum formosum	1.6309	17	Syngnathus elucens	0.0483
18	Vinciguerria nimbaria	1.2286	18	Bothus robindi	0.0445
19	Hildebrandia flava	1.1843	19	Syngnathus scovelli	0.0372
20	Citharichthys macrops	0.8085	20	Syngnathus louisianae	0.0339

Table 39. Continued.

Rank	Cruise CL 7412	
	Species	Mean number under 10 m ²
1	<i>Sardinella anchovia</i>	144.1900
2	<i>Opisthonema oglinum</i>	30.8329
3	<i>Decapterus punctatus</i>	24.0273
4	<i>Diplectrum formosum</i>	22.2088
5	<i>Harengula jaguana</i>	14.4625
6	<i>Etrumeus teres</i>	5.5722
7	<i>Syacium papillosum</i>	5.0484
8	<i>Bregmaceros Type B</i>	4.9434
9	<i>Etropus rimosus</i>	3.2496
10	<i>Bothus robinsi</i>	3.1838
11	<i>Citharichthys macrops</i>	0.9922
12	<i>Serraniculus pumilio</i>	0.7373
13	<i>Echiodon sp.</i>	0.2732
14	<i>Syngnathus elucens</i>	0.2560
15	<i>Sphyræna borealis</i>	0.2509
16	<i>Achirus lineatus</i>	0.2433
17	<i>Chloroscombrus chrysurus</i>	0.2203
18	<i>Cyclopsetta fimbriata</i>	0.1977
19	<i>Menticirrhus saxatilis</i>	0.1707
20	<i>Membras martinicus</i>	0.1420

Table 40. Estimated apparent mortalities, abundances at selected lengths and percent mortalities between the two selected lengths for some common species of larval fishes collected in the eastern Gulf of Mexico. Estimates are based on exponential regressions of abundances on the standard lengths in the table.

Species	Year	Mortality coefficient (Z)	Standard lengths (mm)	Estimated ^a abundances (X 10 ⁹)	Percent mortality
Sardinella anchovia	1971	.4511	6.1-16.0	N _{6.5} = 1513.9	98.27
				N _{15.5} = 26.1	
	1972	.5166	6.1-16.0	N _{6.5} = 58,340.4	99.04
				N _{15.5} = 558.3	
	1973	.4675	6.1-16.0	N _{6.5} = 15,736.3	98.51
				N _{15.5} = 234.1	
Etrumeus teres (Houde, 1977a)	1971-72	.2269	5.1-16.0	N _{6.5} = 5216.7	87.02
				N _{15.5} = 676.9	
	1972-73	.3647	4.1-16.0	N _{6.5} = 5486.3	96.25
				N _{15.5} = 206.0	

Table 40. Continued.

Species	Year	Mortality coefficient (Z)	Standard lengths (mm)	Estimated ^a abundances ($\times 10^9$)	Percent mortality
Opisthonema oglinum (Houde, 1977b)	1971	.3545	4.1-19.0	$N_{6.5} = 13,734.3$	95.88
				$N_{15.5} = 565.2$	
	1973	.3942	5.1-20.0	$N_{6.5} = 13,824.1$	97.12
				$N_{15.5} = 398.0$	
Harengula jaguana (Houde, 1977c)	1973	.3829	3.1-20.0	$N_{6.5} = 1119.0$	96.81
				$N_{15.5} = 35.7$	
Maurolicus muelleri	1971	.2644	4.1-11.0	$N_{4.5} = 2889.0$	79.53
				$N_{10.5} = 591.4$	
	1972	.4500	4.1-11.0	$N_{4.5} = 1610.9$	93.28
				$N_{10.5} = 108.3$	
	1973	.4696	4.1-11.0	$N_{4.5} = 15,514.5$	94.03
				$N_{10.5} = 927.0$	

Table 40. Continued.

Species	Year	Mortality coefficient (Z)	Standard lengths (mm)	Estimated ^a abundances ($\times 10^9$)	Percent mortality
Notolychnus valdiviae	1971-1973	.6051	3.1-10.0	$N_{3.5} = 18,479.8$	97.35
				$N_{9.5} = 489.6$	
Myctophum nitidulum	1971	.6637	3.1-10.0	$N_{3.5} = 8271.3$	98.14
				$N_{9.5} = 154.2$	
	1972	.7050	3.1-10.0	$N_{3.5} = 11,668.6$	98.54
				$N_{9.5} = 169.9$	
	1973	.8997	3.1-10.0	$N_{3.5} = 15,603.3$	99.55
				$N_{9.5} = 70.6$	
Benthosema suborbitale	1971	.6408	3.1-8.0	$N_{3.5} = 2091.9$	92.29
				$N_{7.5} = 161.2$	
	1972	1.0893	3.1-8.0	$N_{3.5} = 29,352.9$	98.72
				$N_{7.5} = 376.1$	

Table 40. Continued.

Species	Year	Mortality coefficient (Z)	Standard lengths (mm)	Estimated ^a abundances (X 10 ⁹)	Percent mortality
Diogenichthys atlanticus	1973	.6366	3.1-8.0	N _{3.5} = 7243.6	92.16
				N _{7.5} = 567.6	
	1971-1973	.7751	3.1-10.0	N _{3.5} = 13,912.9	99.04
				N _{9.5} = 133.0	
Bregmaceros atlanticus	1971	.5616	2.6-8.5	N _{2.8} = 1035.9	95.44
				N _{8.3} = 47.2	
	1972	.3937	2.6-8.5	N _{2.8} = 1420.0	88.53
				N _{8.3} = 162.9	
	1973	.4939	2.6-8.5	N _{2.8} = 1359.3	93.39
				N _{8.3} = 89.9	
Bregmaceros macclellandi	1971-1973	.5861	2.6-5.5	N _{2.8} = 591.2	76.90
				N _{5.3} = 136.6	

Table 40. Continued.

Species	Year	Mortality coefficient (Z)	Standard lengths (mm)	Estimated ^a abundances ($\times 10^9$)	Percent mortality
Bregmaceros Type A	1971	.8847	1.6-8.5	$N_{1.8} = 4482.6$	99.23
				$N_{7.3} = 34.5$	
	1972	.5262	1.6-8.5	$N_{1.8} = 13,597.8$	94.47
				$N_{7.3} = 752.4$	
	1973	.8796	1.6-8.5	$N_{1.8} = 9001.8$	99.21
				$N_{7.3} = 71.3$	
Bregmaceros Type B	1971	.7100	2.1-9.0	$N_{2.3} = 17,101.5$	98.59
				$N_{8.3} = 241.6$	
	1972	.4533	2.1-9.0	$N_{2.3} = 6620.6$	93.41
				$N_{8.3} = 436.2$	
	1973	.8314	2.1-9.0	$N_{2.3} = 34,427.4$	99.32
				$N_{8.3} = 234.7$	

Table 40. Continued.

Species	Year	Mortality coefficient (Z)	Standard lengths (mm)	Estimated ^a abundances (X 10 ⁹)	Percent mortality
Diplectrum formosum	1971	.7664	2.6-8.5	N _{2.8} = 8657.4	97.83
				N _{7.8} = 187.5	
	1972	.9016	2.6-8.5	N _{2.8} = 7930.6	98.90
				N _{7.8} = 87.4	
	1973	.8436	2.6-8.5	N _{2.8} = 9437.4	98.53
				N _{7.8} = 139.0	
Decapterus punctatus	1971	.8709	3.1-9.5	N _{3.3} = 7483.4	99.46
				N _{9.3} = 40.3	
	1972	1.0668	3.1-9.5	N _{3.3} = 16,435.9	99.83
				N _{9.3} = 27.3	
	1973	.8281	3.1-9.5	N _{3.3} = 11,240.2	99.30
				N _{9.3} = 78.2	

Table 40. Continued.

Species	Year	Mortality coefficient (Z)	Standard lengths (mm)	Estimated ^a abundances (X 10 ⁹)	Percent mortality
Trachurus lathami	1971-1973	1.0600	2.6-9.5	N _{2.8} = 3978.2 N _{9.3} = 4.1	99.90
Chloroscombrus chrysurus	1971-1973	1.3051	2.6-5.5	N _{2.8} = 3039.6 N _{5.3} = 116.4	96.17
Orthopristis chrysoptera	1971-1973	1.0730	5.6-9.0	N _{5.8} = 882.5 N _{8.8} = 35.3	96.00
Euthynnus alletteratus	1971-1973	.8963	3.1-9.0	N _{3.5} = 14,328.9 N _{8.5} = 162.2	98.87
Thunnus atlanticus	1971-1973	1.0339	3.1-9.0	N _{3.5} = 10,783.8 N _{8.5} = 61.3	99.43
Githarichthys cornutus	1971	0.4702	4.1-14.0	N _{4.5} = 5558.0 N _{13.5} = 80.7	98.55

Table 40. Continued.

Species	Year	Mortality coefficient (Z)	Standard lengths (mm)	Estimated ^a abundances ($\times 10^9$)	Percent mortality
Citharichthys macrops	1972	.2645	4.1-14.0	$N_{4.5} = 2457.5$	90.75
				$N_{13.5} = 227.3$	
	1973 (Dowd, 1978)	.3249	4.1-14.0	$N_{4.5} = 3067.6$	94.63
				$N_{13.5} = 164.8$	
	1971	.5625	4.1-10.0	$N_{4.5} = 1391.4$	94.00
				$N_{9.5} = 83.5$	
	1972	.4114	4.1-10.0	$N_{4.5} = 816.7$	87.23
				$N_{9.5} = 104.4$	
Citharichthys gymnorhinus	1973 (Dowd, 1978)	.3875	4.1-10.0	$N_{4.5} = 1559.4$	85.59
				$N_{9.5} = 224.7$	
	1971	.4443	4.1-12.0	$N_{4.5} = 1078.0$	95.54
				$N_{11.5} = 48.1$	

Table 40. Continued.

Species	Year	Mortality coefficient (Z)	Standard lengths (mm)	Estimated ^a abundances ($\times 10^9$)	Percent mortality
<i>Etropus rimosus</i>	1972	.4032	4.1-13.0	$N_{4.5} = 1561.4$	94.05
				$N_{11.5} = 92.8$	
	1973 (Dowd, 1978)	.2741	4.1-12.0	$N_{4.5} = 2455.5$	88.32
				$N_{11.5} = 360.5$	
	1971	.4920	4.1-12.0	$N_{4.5} = 10,594.1$	96.81
				$N_{11.5} = 338.2$	
<i>Syacium papillosum</i>	1972	.5058	4.1-11.0	$N_{4.5} = 5324.0$	97.10
				$N_{11.5} = 154.3$	
	1973	.4393	4.1-12.0	$N_{4.5} = 9108.0$	95.38
				$N_{11.5} = 420.7$	
	1971	.5923	3.1-12.0	$N_{3.3} = 12,576.9$	99.13
				$N_{11.3} = 110.1$	

Table 40. Continued.

Species	Year	Mortality coefficient (Z)	Standard lengths (mm)	Estimated ^a abundances ($\times 10^9$)	Percent mortality
Bothus robinsi	1972	.5748	3.1-12.0	$N_{3.3} = 8554.2$	98.99
				$N_{11.3} = 86.1$	
	1973 (Dowd, 1978)	.5832	3.1-12.0	$N_{3.3} = 28,567.9$	99.06
				$N_{11.3} = 268.9$	
	1971	.4595	5.1-16.0	$N_{5.5} = 4903.0$	98.99
				$N_{15.5} = 49.5$	
	1973 (Dowd, 1978)	.3983	5.1-16.0	$N_{5.5} = 8587.4$	98.14
				$N_{15.5} = 160.0$	

^aThe subscripted numbers are the length-classes (mm) for which the abundance estimates are made.

Table 41. Estimates of biomass of some common fishes from the eastern Gulf of Mexico, based on egg or larval production estimates. Eggs and larvae were collected on 17 cruises to the eastern Gulf of Mexico, 1971-1974.

Species	Reference	Estimate from eggs or larvae	Year	Biomass estimates (metric tons)
<i>Etrumeus teres</i>	Houde, 1977a	Eggs	1971-72	717,815
<i>E. teres</i>	"	"	1972-73	131,136
<i>Opisthonema oglinum</i>	Houde, 1977b	Eggs	1971	110,024
<i>O. oglinum</i>	"	"	1972	47,316
<i>O. oglinum</i>	"	"	1973	372,367
<i>Harengula jaguana</i>	Houde, 1977c	Eggs	1971	16,282
<i>H. jaguana</i>	"	"	1972	93,168
<i>H. jaguana</i>	"	"	1973	330,334
<i>Decapterus punctatus</i>	Leak, 1977	Larvae	1971	83,942
<i>D. punctatus</i>	"	"	1972	248,666
<i>D. punctatus</i>	"	"	1973	147,394

Table 41. Continued.

Species	Reference	Estimate from eggs or larvae	Year	Biomass estimates (metric tons)
Trachurus lathami	Leak, 1977.	Larvae	1971-72	21,440
T. lathami	"	"	1972-73	27,700
Syacium papillosum		Larvae	1971	78,730
S. papillosum		"	1972	52,352
S. papillosum	Dowd, 1978	"	1973	177,000
Thunnus thynnus		Larvae	1972	48,416
T. thynnus		"	1973	25,328

Table 42. The 20 most frequently collected, identified species of fish larvae collected on 17 cruises to the eastern Gulf of Mexico, 1971-1974. These 20 species comprise 89.4% of all larvae that were identified to species and 37.3% of all larvae that were collected.

Rank	Species	Number of larvae
1	<i>Sardinella anchovia</i>	12,311
2	<i>Opisthonema oglinum</i>	11,315
3	<i>Decapterus punctatus</i>	4,431
4	<i>Diplectrum formosum</i>	3,963
5	<i>Harengula jaguana</i>	3,846
6	<i>Syacium papillosum</i>	3,317
7	<i>Bregmaceros Type B</i>	2,554
8	<i>Bothus robinsi</i>	1,955
9	<i>Etropus rimosus</i>	1,843
10	<i>Maurolicus muelleri</i>	1,102
11	<i>Etrumeus teres</i>	1,089
12	<i>Bregmaceros Type A</i>	962
13	<i>Chloroscombrus chrysurus</i>	774
14	<i>Orthopristis chrysoptera</i>	771
15	<i>Citharichthys cornutus</i>	765
16	<i>Citharichthys macrops</i>	637
17	<i>Myctophum nitidulum</i>	613
18	<i>Hemanthias vivanus</i>	395
19	<i>Serraniculus pumilio</i>	390
20	<i>Euthynnus alletteratus</i>	361
TOTAL		53,394

Table 43. Estimated, weighted mean abundances for the 20 most frequently collected, identified fish larvae from 17 cruises to the eastern Gulf of Mexico, 1971-1974. The mean numbers under 10 m² of sea surface are given for <50 and >50 m depth zones and for the northern and southern sectors of the survey area. The weighting factors are the areas represented in each of the zones on each cruise.

Species	Weighted Mean Abundance (number under 10 m ²)			
	<50 m	>50 m	North	South
<i>Sardinella anchovia</i>	42.1144	0.7612	20.3615	30.9964
<i>Opisthonema oglinum</i>	30.7094	0.2980	6.6870	30.5058
<i>Decapterus punctatus</i>	12.5488	11.8138	9.5610	15.0375
<i>Diplectrum formosum</i>	11.5214	1.9116	5.6098	9.8125
<i>Harengula jaguana</i>	4.7855	0.0967	4.5759	1.2844
<i>Syacium papillosum</i>	6.5943	24.9596	10.4485	17.0807
<i>Bregmaceros Type B</i>	2.8984	31.6744	16.1689	11.5056
<i>Bothus robinsi</i>	4.0250	16.4701	5.7597	12.2956
<i>Etropus rimosus</i>	5.2858	3.6205	5.8299	3.3688
<i>Maurolicus muelleri</i>	0.0721	24.5544	14.5922	5.4154
<i>Etrumeus teres</i>	2.1029	7.1858	5.7524	4.2940
<i>Bregmaceros Type A</i>	0.0290	16.3308	3.8711	9.3690
<i>Chloroscombrus chrysurus</i>	1.6957	0.0000	0.3441	1.7315
<i>Orthopristis chrysoptera</i>	0.7378	0.0000	0.7184	0.2120
<i>Citharichthys cornutus</i>	0.1269	7.2283	2.1550	3.8988
<i>Citharichthys macrops</i>	1.8281	0.3340	0.8457	1.2677
<i>Myctophum nitidulum</i>	0.0802	12.1857	7.0138	4.3552
<i>Hemanthias vivanus</i>	0.0214	5.2881	0.6626	3.1154
<i>Serraniculus pumilio</i>	0.9595	0.0310	0.4841	0.6975
<i>Euthynnus alletteratus</i>	0.4233	4.1264	2.1344	1.6857

Table 44. Ninety-four species of larval fishes included in the taxocene used for diversity estimation. Individuals of these species were observed 10 or more times during the 17 cruises. Also given are the minimum and maximum surface temperatures, surface salinities and depths of occurrence for each of the species.

Family	Species	Temperature (°C)		Salinity (°/oo)		Depth (m)	
		Min	Max	Min	Max	Min	Max
Clupeidae	<i>Etrumeus teres</i>	17	27	34	36	15	823
	<i>Opisthonema oglinum</i>	18	31	27	37	4	101
	<i>Harengula jaguana</i>	18	30	27	37	4	155
	<i>Sardinella anchovia</i>	21	32	27	36	4	146
Gonostomatidae	<i>Gonostoma elongatum</i>	21	30	23	36	46	3,329
	<i>Maurolicus muelleri</i>	21	30	23	36	46	3,292
	<i>Polymetme (?) Type I</i>	22	30	34	36	62	3,292
	<i>Vinciguerrria nimbaria</i>	21	30	25	36	25	3,329
	<i>V. poweriae</i>	21	30	27	36	51	3,329
	<i>V. attenuata</i>	23	30	25	36	46	3,329
Myctophidae	<i>Notolychnus valdiviae</i>	23	30	26	37	48	3,329
	<i>Lampadena luminosa</i>	23	30	23	36	31	3,329
	<i>Lampanyctus alatus</i>	22	30	25	36	57	3,329
	<i>L. cuprarius</i>	24	30	32	36	66	2,926
	<i>Myctophum nitidulum</i>	18	30	23	36	25	3,329
	<i>M. selenops</i>	21	30	27	36	46	3,329

Table 44. Continued.

Family	Species	Temperature (°C)		Salinity (‰)		Depth (m)	
		Min	Max	Min	Max	Min	Max
	<i>Hygophum reinhardtii</i>	21	30	31	36	53	3,329
	<i>Ceratoscopelus warmingi</i>	22	30	31	36	40	3,292
	<i>Centrobranchus nigroocellatus</i>	22	30	31	36	64	3,329
	<i>Notoscopelus caudispinosus</i>	21	25	36	36	25	677
	<i>N. resplendens</i>	21	30	32	36	35	3,329
	<i>Lobiancha gemerelli</i>	25	30	31	36	71	3,329
	<i>Benthoosema suborbitale</i>	21	30	23	36	51	3,329
	<i>Diogenichthys atlanticus</i>	22	30	23	36	49	3,329
	<i>Symbolophorus rufinus</i>	25	27	36	36	62	677
Chlorophthalmidae	<i>Chlorophthalmus agassizi</i>	23	29	34	36	46	3,256
Muraenidae	<i>Gymnothorax nigromarginatus</i>	23	30	32	37	15	2,926
Nettastomidae	<i>Hoplunnis diomedianus</i>	21	30	32	36	46	165
Congridae	<i>Ariosoma balearicum</i>	24	30	26	36	64	2,926
	<i>Paraconger caudilimbatus</i>	28	30	31	36	35	2,926
	<i>Hildebrandia flava</i>	26	30	26	36	146	677
	<i>H. gracilior</i>	22	30	31	36	57	2,926

Table 44. Continued.

Family	Species	Temperature (°C)		Salinity (‰)		Depth (m)	
		Min	Max	Min	Max	Min	Max
Ophichthidae	Myrophis punctatus	16	26	34	36	16	823
Hemiramphidae	Hyporhamphus unifasciatus	16	30	27	36	9	155
Exocoetidae	Parexocoetus brachypterus	24	30	34	36	20	60
	Prognichthys gibbifrons	23	31	26	37	20	823
Bregmacerotidae	Bregmaceros atlanticus	21	30	23	36	25	3,292
	B. type A	21	30	32	36	25	3,256
	B. Type B	19	30	25	37	16	3,329
	B. maclellandi	22	30	31	36	25	3,292
Syngnathidae	Hippocampus erectus	16	29	30	36	7	66
	Syngnathus elucens	19	30	31	36	9	77
	S. springeri	16	29	33	36	9	53
	S. louisianae	17	25	31	37	5	15
	S. scovelli	17	30	27	36	4	20
Atherinidae	Membras martinicus	24	27	30	35	5	9
Sphyraenidae	Sphyraena barracuda	23	29	35	36	26	2,926
	S. borealis	20	29	33	36	9	165

Table 44. Continued.

Family	Species	Temperature (°C)		Salinity (‰)		Depth (m)	
		Min	Max	Min	Max	Min	Max
Serranidae	Anthias Type 1	22	29	34	36	24	677
	A. Type 3	23	27	35	36	25	677
	Diplectrum formosum	17	32	31	37	9	155
	Centropristis striata	16	28	32	36	4	188
	Hemanthias vivanus	22	30	31	36	15	677
	Pronotogrammus aurorubens	21	30	31	36	22	677
	Serraniculus pumilio	22	31	33	37	9	155
Carangidae	Caranx crysos	29	30	31	36	46	1,646
	Chloroscombrus chrysurus	24	31	27	37	9	40
	Decapterus punctatus	20	32	27	37	9	3,292
	Oligoplites saurus	25	30	32	37	9	15
	Selene vomer	29	30	23	33	60	2,926
	Trachurus lathami	18	26	35	36	20	219
Lutjanidae	Pristipomoides aquilonaris	24	30	31	36	46	677
Pomadasyidae	Orthopristis chrysoptera	15	25	30	36	4	31

Table 44. Continued.

Family	Species	Temperature (°C)		Salinity (‰)		Depth (m)	
		Min	Max	Min	Max	Min	Max
Sciaenidae	Cynoscion arenarius	18	30	32	36	5	16
	C. nebulosus	18	29	30	37	5	15
	Leiostomus xanthurus	15	27	30	36	4	58
	Menticirrhus saxatilis	19	29	33	36	7	20
	Micropogon undulatus	16	27	33	36	9	29
Sparidae	Diplodus holbrooki	16	18	34	35	4	15
	Lagodon rhomboides	15	26	33	36	7	64
	Archosargus probatocephalus	17	27	31	36	9	20
Carapidae	Carapus bermudensis	25	29	31	36	27	161
	Echiodon sp.	21	30	25	36	25	677
Scombridae	Auxis sp.	22	30	25	36	9	3,292
	Euthynnus alletteratus	24	30	23	36	18	2,926
	Katsuwonus pelamis	25	30	32	36	79	3,292
	Thunnus atlanticus	26	30	23	36	20	3,292
	T. thynnus	24	27	36	36	62	3,292
	Scomberomorus maculatus	23	30	27	36	9	46

Table 44. Continued.

Family	Species	Temperature (°C)		Salinity (‰)		Depth (m)	
		Min	Max	Min	Max	Min	Max
Stromateidae	Peprilus paru	25	30	35	36	9	64
Nomeidae	Cubiceps pauciradiatus	22	30	30	36	27	3,292
	Psenes pellucidus	24	29	35	36	53	219
Bothidae	Citharichthys cornutus	21	30	25	36	22	3,329
	C. macrops	17	30	27	37	9	3,384
	C. spilopterus	23	30	32	36	25	2,926
	C. gymnorhinus	19	30	25	36	15	677
	Cyclopsetta fimbriata	23	30	30	37	9	2,698
	Etropus rimosus	16	30	31	37	9	329
	Syacium papillosum	19	32	25	37	5	2,835
	Engyophrys senta	29	30	25	34	64	1,646
	Monolene sessilicauda	23	29	35	36	25	188
	Bothus robinsi	17	32	25	37	5	3,329
Soleidae	Achirus lineatus	24	30	27	37	9	73
	Gymnachirus melas	22	27	33	36	15	53

Table 45. Frequency distribution of stations for species of larval fishes collected on five cruises to the eastern Gulf of Mexico in 1973. Frequencies are based only on the 94 relatively common species included in the taxocene used for diversity estimation. Frequencies and mean numbers of species per station are given for all stations and for stations in the < 50 and > 50 m depth zones. A summary distribution, based on all five cruises combined, also is presented.

Cruise	Numbers of Species and Stations								
	All stations			<50 m stations			>50 m stations		
	Number of species	Number of stations	Mean species per station	Number of species	Number of stations	Mean species per station	Number of species	Number of stations	Mean species per station
IS 7303	0- 3	12		0- 3	11		0- 3	1	
	4- 7	22	6.43	4- 7	19	4.56	4- 7	3	10.18
	8-11	10		8-11	4		8-11	6	
	12-15	7		12-15	0		12-15	7	
IS 7308	0- 3	2		0- 3	2		0- 3	0	
	4- 7	28	7.69	4- 7	24	6.65	4- 7	4	10.07
	8-11	12		8-11	6		8-11	6	
	12-15	4		12-15	2		12-15	2	
	16-19	1		16-19	0		16-19	1	
	20-23	2		20-23	0		20-23	2	
IS 7311	0- 3	11		0- 3	11		0- 3	0	
	4- 7	26	7.43	4- 7	19	5.94	4- 7	7	10.41
	8-11	5		8-11	4		8-11	1	
	12-15	8		12-15	0		12-15	8	
	16-19	1		16-19	0		16-19	1	

Table 45. Continued.

Cruise	Numbers of Species and Stations								
	All stations			<50 m stations			>50 m stations		
	Number of species	Number of stations	Mean species per station	Number of species	Number of stations	Mean species per station	Number of species	Number of stations	Mean species per station
IS 7313	0- 3	4	7.48	0- 3	4	6.26	0- 3	0	10.06
	4- 7	24		4- 7	20		4- 7	4	
	8-11	18		8-11	10		8-11	8	
	12-15	2		12-15	0		12-15	2	
	16-19	2		16-19	0		16-19	2	
IS 7320	0- 3	11	6.04	0- 3	11	4.33	0- 3	0	9.17
	4- 7	26		4- 7	18		4- 7	8	
	8-11	9		8-11	4		8-11	5	
	12-15	4		12-15	0		12-15	4	
	16-19	1		16-19	0		17-19	1	
All Five Cruises Combined	0- 3	40	7.01	0- 3	39	5.56	0- 3	1	9.96
	4- 7	126		4- 7	100		4- 7	26	
	8-11	54		8-11	28		8-11	26	
	12-15	25		12-15	2		12-15	23	
	16-19	5		16-19	0		16-19	5	
	20-23	2		20-23	0		20-23	2	

Table 46. Estimates of Shannon-Weaver diversity (H'), evenness (J), Simpson's index of diversity (C) and species richness (R) for fish larvae collected in 17 cruises to the eastern Gulf of Mexico, 1971-1974. The number of species (S) and the number of individuals (N) used to obtain the estimates also are given. Species richness was estimated only for those cruises where number of stations and sampling pattern were alike.

Cruise	Month	S	N	H'	J	C	R
GE 7101	Feb.	48	3,230	2.5761	.6655	.1142	--
8C 7113- TI 7114	May	66	6,220	2.7930	.6667	.1003	--
GE 7117	June	30	732	2.4114	.7090	.1263	--
8C 7120- TI 7121	Aug.	68	6,618	3.1948	.7572	.0654	--
TI 7131- 8B 7132	Nov.	58	1,463	3.0115	.7417	.0793	--
8B 7201- GE 7202	Feb.	48	875	2.7158	.7016	.1139	--
GE 7208	May	67	2,773	3.0568	.7270	.0601	--
GE 7210	June	19	1,487	1.0459	.3552	.5647	--
IS 7205	Sept.	53	5,936	2.0538	.5173	.2545	--
IS 7209	Nov.	51	1,333	2.7932	.7104	.1010	6.9491
IS 7303	Jan.	53	1,875	3.0313	.7635	.0708	6.7672
IS 7308	May	63	6,189	3.1696	.7650	.0608	7.1015
IS 7311	June-July	57	5,669	2.5430	.6289	.1444	6.4794
IS 7313	Aug.	57	4,195	2.7253	.6741	.1129	6.5934
IS 7320	Nov.	54	1,709	2.6717	.6698	.1384	7.1201
CL 7405	Feb.-Mar.	21	747	1.9508	.6408	.2004	--
CL 7412	May	33	8,437	1.6187	.4629	.3368	--

Table 47. Analysis of variance to determine if there were significant differences in the evenness coefficients (J) among years for 14 ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973. Cruise GE 7210 is not included in the analysis because only 13 stations were sampled on it and all were at depths < 50 m.

EVENNESS COEFFICIENTS			
	<u>1971</u>	<u>1972</u>	<u>1973</u>
	.6655	.7016	.7635
	.6667	.7270	.7650
	.7090	.5173	.6289
	.7572	.7104	.6741
	.7417		.6698
Mean	.7080	.6641	.7003
$S_{\bar{x}}$.0188	.0492	.0273

ANALYSIS OF VARIANCE				
<u>Source</u>	<u>SS</u>	<u>d.f.</u>	<u>MS</u>	<u>F</u>
Total	.0557	13		
Years	.0048	2	.0024	0.522 n.s.
Within Years	.0509	11	.0046	

$$F_{.05(1)2,11} = 3.98$$

$$P > .50$$

Table 48. Analysis of variance to determine if there were significant differences in the evenness coefficients (J) among seasons for 17 ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974.

EVENNESS COEFFICIENTS				
	<u>Winter</u>	<u>Spring</u>	<u>Summer</u>	<u>Fall</u>
	.6655	.6667	.7090	.7417
	.7016	.7270	.7572	.7104
	.7635	.7650	.3552	.6698
	.6408	.4629	.5173	
			.6289	
			.6741	
Mean	<u>.6929</u>	<u>.6554</u>	<u>.6070</u>	<u>.7073</u>
$S_{\bar{x}}$.0267	.0673	.0604	.0207

ANALYSIS OF VARIANCE				
<u>Source</u>	<u>SS</u>	<u>d.f.</u>	<u>MS</u>	<u>F</u>
Total	.2026	16		
Seasons	.0278	3	.0093	0.694 n.s.
Within Seasons	.1748	13	.0134	

$$F_{.05(1)3,13} = 3.41$$

$$P > .50$$

Table 49. A comparison of ichthyoplankton diversity in the northern and southern sectors of the eastern Gulf of Mexico. Northern and southern sectors were designated by latitude $27^{\circ}15'N$. Shannon-Weaver diversities (H'), evenness (J), Simpson's index of diversity (C) and species richness (R). The number of species (S) and number of individuals (N) used to obtain estimates also are given.

Cruise	Month	NORTH						SOUTH					
		S	N	H'	J	C	R	S	N	H'	J	C	R
8C 7113- TI 7114	May	53	3,353	2.6976	.6795	.1007	--	65	2,867	2.7500	.6588	.1113	--
8C 7120- TI 7121	Aug.	--	--	--	--	--	--	60	3,923	3.1497	.7693	.0645	--
TI 7131 8B 7132	Nov.	53	1,120	2.9847	.7518	.0803	--	--	--	--	--	--	--
8B 7201- GE 7202	Feb.	28	352	2.2340	.6704	.1724	--	44	523	2.6671	.7048	.1094	--
GE 7208	May	--	--	--	--	--	--	59	2,108	3.1658	.7764	.0600	--
IS 7205	Sept.	40	2,759	2.0690	.5609	.2031	--	44	3,177	1.9145	.5059	.2787	--
IS 7209	Nov.	37	556	2.5016	.6928	.1412	5.6955	45	777	2.7946	.7341	.0966	6.6111
IS 7303	Jan.	38	810	2.5174	.6920	.1383	5.5248	44	1,065	3.1423	.8304	.0597	6.1686
IS 7308	May	42	2,638	3.1399	.8380	.0594	5.2045	50	3,555	2.6360	.6738	.0872	5.5038
IS 7311	June-July	41	1,078	2.4170	.6509	.1468	5.7283	48	4,591	2.3143	.5978	.2508	5.5741

Table 49. Continued.

Cruise	Month	NORTH						SOUTH					
		S	N	H'	J	C	R	S	N	H'	J	C	R
IS 7313	Aug.	47	2,437	2.3365	.6069	.1600	5.8986	51	1,759	2.7936	.7105	.0997	6.6912
IS 7320	Nov.	38	724	2.2221	.6109	.2208	5.6190	46	985	2.7005	.7053	.1094	6.5287
CL 7412	May	27	4,052	1.4189	.4305	.4066	--	22	4,385	1.5816	.5117	.3109	--

Table 50. Values of the evenness coefficient (J) for 10 ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974. Values for the northern and southern sectors of the survey area are given and results of a paired-t test to determine if there were significant differences in evenness between the two sectors are presented.

Cruise	Evenness (J)		Difference (d)
	North	South	
8C 7113- TI 7114	.6795	.6588	+.0207
8B 7201- GE 7202	.6704	.7048	-.0344
IS 7205	.5609	.5059	+.0550
IS 7209	.6928	.7341	-.0413
IS 7303	.6920	.8304	-.1384
IS 7308	.8380	.6738	+.1642
IS 7311	.6509	.5978	+.0531
IS 7313	.6069	.7105	-.1036
IS 7320	.6109	.7053	-.0944
CL 7412	.4305	.5117	-.0812

$$\Sigma d = -.2003$$

$$\bar{d} = -.0200$$

$$s_{\bar{d}} = .0293$$

$$t_{.05(2)9} = 2.262$$

$$t = \bar{d}/s_{\bar{d}} = -0.682$$

$$P > .50$$

Table 51. A comparison of ichthyoplankton diversity in the onshore (<50 m depth zone) and offshore (>50 m depth zone) sectors of the eastern Gulf of Mexico. Shannon-Weaver diversity (H'), evenness (J), Simpson's index of diversity (C) and species richness (R). The number of species (S) and number of individuals (N) used to obtain estimates also are given.

Cruise	Month	<50 m						>50 m					
		S	N	H'	J	C	R	S	N	H'	J	C	R
8C 7113- TI 7114	May	41	4,477	2.0992	.5653	.1719	--	55	1,743	3.0277	.7556	.0704	--
GE 7117	June	21	383	1.9302	.6340	.2481	--	25	349	2.2986	.7141	.1531	--
8C 7120- TI 7121	Aug.	32	2,805	2.0481	.5910	.1745	--	63	3,813	3.2169	.7764	.0698	--
TI 7131- 8B 7132	Nov.	30	495	2.3407	.6882	.1337	--	45	968	2.9802	.7829	.0838	--
8B 7201 GE 7202	Feb.	19	348	1.9399	.6589	.1931	--	44	527	2.7938	.7383	.0935	--
GE 7208	May	28	1,716	1.8542	.5564	.2132	--	51	1,057	3.1688	.8060	.0737	--
IS 7205	Sept.	30	5,118	1.1605	.3412	.5421	--	35	816	2.3065	.6487	.1471	--
IS 7209	Nov.	19	535	1.9916	.6764	.1672	2.8652	45	798	2.7102	.7120	.1144	6.5847
IS 7303	Jan.	28	1,042	2.4266	.7208	.1160	3.8855	42	833	2.9808	.7975	.0841	6.0966
IS 7308	May	27	5,119	1.9306	.5858	.1829	3.0442	46	1,070	3.1976	.8352	.0587	6.4512

Table 51. Continued.

Cruise	Month	<50 m						>50 m					
		S	N	H'	J	C	R	S	N	H'	J	C	R
IS 7311	June-July	23	4,733	1.2280	.3916	.4621	2.5998	45	936	2.7597	.7250	.1328	6.4312
IS 7313	Aug.	25	3,125	1.9598	.6088	.2144	2.9824	42	1,070	2.3666	.6332	.1830	5.8778
IS 7320	Nov.	24	559	2.1829	.6869	.1441	3.6357	44	1,150	2.5295	.6684	.1494	6.1014
CL 7412	May	30	8,232	1.3761	.4046	.3958	--	--	--	--	--	--	--

Table 52. Values of the evenness coefficient (J) for 13 ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973. Values for <50 m and >50 m depth zones of the survey area are given and results of a paired-t test to determine if there were significant differences in evenness between the two zones are presented.

Cruise	Evenness (J)		Difference (d)
	<50 m	>50 m	
8C 7113- TI 7114	.5653	.7556	-.1903
GE 7117	.6340	.7141	-.0801
8C 7120- TI 7121	.5910	.7764	-.1854
TI 7131- 8B 7132	.6882	.7829	-.0947
8B 7201- GE 7202	.6589	.7383	-.0794
GE 7208	.5564	.8060	-.2496
IS 7205	.3412	.6487	-.3075
IS 7209	.6764	.7120	-.0356
IS 7303	.7208	.7975	-.0767
IS 7308	.5858	.8352	-.2494
IS 7311	.3916	.7250	-.3334
IS 7313	.6088	.6332	-.0244
IS 7320	.6869	.6684	+.0185

$$\Sigma d = -1.8086$$

$$\bar{d} = -0.1391$$

$$s_{\bar{d}} = 0.0339$$

$$t_{.05(2)12} = 2.179$$

$$t = \bar{d}/s_{\bar{d}} = -4.107$$

$$.001 < P < .002$$

Table 53. Mean values of the evenness coefficient (J) for stations on transects off Sanibel Island (lat. 26°30'N) and off Tampa Bay (lat. 27°30'N) from 11 ichthyoplankton survey cruises. Results of the paired-t test to determine if there were significant differences in evenness between the two transects also are given.

Cruise	Evenness (J)		Difference (d)
	Sanibel	Tampa	
8C 7113- TI 7114	.6898	.6699	+.0199
8C 7120- TI 7121	.7416	.7796	-.0380
TI 7131- 8B 7132	.7474	.6919	+.0555
GE 7208	.6560	.7613	-.1053
IS 7205	.6264	.6338	-.0074
IS 7209	.7415	.6974	+.0441
IS 7303	.7321	.6398	+.0923
IS 7308	.5654	.6662	-.1008
IS 7311	.6548	.6466	+.0082
IS 7313	.7011	.7719	-.0708
IS 7320	.6462	.7281	-.0819

$$\Sigma d = -.1694$$

$$\bar{d} = -.0154$$

$$s_{\bar{d}} = .0204$$

$$t_{.05(2)10} = 2.228$$

$$t = \bar{d}/s_{\bar{d}} = -0.754$$

$$P > .20$$

Table 54. Within cruise comparisons, using Student's t test, to determine if there are significant differences in Shannon-Weaver diversity coefficients (H') between <50 m and >50 m areas, and between North and South sectors of the survey area. The diversity estimates are based on a taxocene of 94 possible species of fish larvae collected in the eastern Gulf of Mexico, 1971-1974.

Cruise	Shannon-Weaver Coefficient		t	d.f.	Probability level	Shannon-Weaver Coefficient		t	d.f.	Probability level
	<50 m	>50 m				North	South			
8C 7113-TI 7114	2.0992	3.0277	28.24	3,049	P<.001	2.6976	2.7500	1.72	4,343	.05<P<.10
GE 7117	1.9302	2.2986	4.60	625	P<.001	--	--	--	--	--
8C 7120-TI 7121	2.0481	3.2169	43.53	6,414	P<.001	--	--	--	--	--
TI 7131-8B 7132	2.3047	2.9801	10.55	1,051	P<.001	--	--	--	--	--
8B 7201-GE 7202	1.9399	2.7938	11.08	785	P<.001	2.2340	2.6671	4.99	744	P <.001
GE 7208	1.8542	3.1688	31.44	2,350	P<.001	--	--	--	--	--
GE 7210	--	--	--	--	--	--	--	--	--	--
IS 7205	1.1605	2.3065	24.13	1,149	P<.001	2.0690	1.9145	4.15	6,403	P<.001
IS 7209	1.9916	2.7102	11.97	1,326	P<.001	2.5016	2.7946	4.24	1,145	P<.001
IS 7303	2.4266	2.9808	12.51	1,837	P<.001	2.5174	3.1423	11.95	1,288	P<.001
IS 7308	1.9306	3.1976	36.27	1,493	P<.001	3.1321	2.6360	15.06	5,773	P<.001
IS 7311	1.2280	2.7597	32.23	1,342	P<.001	2.4170	2.3143	2.23	2,101	.025<P<.05
IS 7313	1.9598	2.3666	8.49	1,560	P<.001	2.3365	2.7936	10.95	4,121	P<.001
IS 7320	2.1829	2.5295	5.98	1,441	P<.001	2.2221	2.7005	7.01	1,405	P<.001
CL 7405	--	--	--	--	--	--	--	--	--	--
CL 7412	--	--	--	--	--	1.4189	1.5816	5.74	8,063	P<.001

Table 55. Significant correlations between the logarithm of abundance (no. under 10 m^2) of 94 species of larval fishes and environmental variables in the eastern Gulf of Mexico. Data are pooled from all 17 cruises, 1971-1974 (* $P < .05$; ** $P < .01$).

Species	Surface temperature	Surface salinity	Station depth	Latitude	Log plankton volume
<i>Etrumeus teres</i>	--	--	--	--	--
<i>Harengula jaguana</i>	--	-.22*	--	+.22*	+.23*
<i>Opisthonema oglinum</i>	+.26**	+.24**	--	-.22**	--
<i>Sardinella anchovia</i>	--	+.15*	--	--	--
<i>Gonostoma elongatum</i>	--	--	--	--	--
<i>Maurolicus muelleri</i>	--	--	--	--	--
<i>Polymetme (?) Type I</i>	--	--	--	--	--
<i>Vinciguerria nimbaria</i>	+.44**	-.33**	+.27*	+.36**	--
<i>Vinciguerria poweriae</i>	--	--	+.32*	--	--
<i>Vinciguerria attenuata</i>	--	--	--	--	--
<i>Notolychnus valdiviae</i>	--	--	--	--	--
<i>Lampadena luminosa</i>	+.51**	--	+.51**	--	--
<i>Lampanyctus alatus</i>	--	--	--	--	--
<i>Lampanyctus cuprarius</i>	--	--	--	--	--
<i>Myctophum nitidulum</i>	--	--	+.19*	--	--
<i>Myctophum selenops</i>	--	--	+.58**	--	--

Table 55. Continued.

Species	Surface temperature	Surface salinity	Station depth	Latitude	Log plankton volume
Hygophum reinhardti	--	--	--	--	+.44*
Ceratoscopelus warmingi	--	--	--	--	-.37*
Centrobranchus nigroocellatus	--	--	--	--	--
Notoscopelus caudispinosus	--	--	--	--	--
Notoscopelus resplendens	--	--	--	--	--
Lobiancha gemellari	--	--	--	--	--
Benthoosema suborbitale	--	--	--	--	--
Diogenichthys atlanticus	--	--	--	--	--
Symbolophorus rufinus	--	--	--	--	--
Chlorophthalmus agassizi	+.88**	--	--	+.69*	--
Gymnothorax nigromarginatus	--	--	--	--	--
Hoplunnis diomedianus	--	--	--	--	--
Ariosomma balearicum	--	--	--	--	--
Paraconger caudilimbatus	--	--	--	--	--
Hildebrandia flava	--	--	--	--	--
Hildebrandia gracilior	--	--	--	+.37	--
Myrophis punctatus	+.60	--	--	--	-.57

Table 55. Continued.

Species	Surface temperature	Surface salinity	Station depth	Latitude	Log plankton volume
Hyporhamphus unifasciatus	--	--	--	--	--
Parexocoetus brachypterus	--	--	--	--	--
Prognichthys gibbifrons	+.44*	-.54**	+.46*	+.54**	-.60*
Bregmaceros atlanticus	--	--	--	--	--
Bregmaceros Type A	--	--	--	--	--
Bregmaceros Type B	+.13*	-.14*	--	+.28**	--
Bregmaceros maclellandi	--	--	--	--	--
Hippocampus erectus	--	--	+.67**	--	--
Syngnathus elucens	+.38	--	+.49**	+.30*	--
Syngnathus springeri	--	--	+.38*	+.43**	--
Syngnathus louisianae	--	--	--	--	--
Syngnathus scovelli	--	--	--	+.61**	--
Membras martinicus	+.99*	--	--	--	--
Sphyraena barracuda	--	--	--	--	--
Sphyraena borealis	--	--	--	+.58	--
Anthias Type I	--	--	+.50**	+.43*	--
Anthias Type III	+.73*	--	--	+.75*	--
Diplectrum formosum	-.18**	--	--	--	--

Table 55. Continued.

Species	Surface temperature	Surface salinity	Station depth	Latitude	Log plankton volume
Centropristis striata	--	--	--	--	--
Hemanthias vivanus	--	--	--	--	--
Pronotogrammus aureorubens	--	--	--	+.40*	--
Serraniculus pumilio	+.21*	--	+.17*	--	--
Caranx crysos	--	--	--	--	--
Chloroscombrus chrysurus	+.36**	--	--	--	--
Decapterus punctatus	+.09*	+.12**	--	--	--
Oligoplites saurus	--	--	--	--	--
Selene vomere	--	--	--	--	--
Trachurus lathamii	--	--	--	+.31*	--
Pristipomoides aquilonaris	--	--	--	--	--
Orthopristis chrysoptera	--	--	+.24*	--	--
Cynoscion arenarius	--	--	--	--	--
Cynoscion nebulosus	--	--	--	--	--
Leiostomus xanthurus	--	--	--	--	--
Menticirrhus saxatilis	--	+.67*	--	--	--
Micropogon undulatus	--	--	--	--	--

Table 55. Continued.

Species	Surface temperature	Surface salinity	Station depth	Latitude	Log plankton volume
Diplodus holbrooki	--	--	--	--	--
Lagodon rhomboides	--	+.34*	+.48**	--	--
Archosargus probatocephalus	--	--	-.49*	--	--
Carapus bermudensis	--	--	--	--	--
Echiodon sp.	+.20*	--	--	+.20*	--
Auxis sp.	+.20*	-.26**	--	+.28**	--
Euthynnus alletteratus	+.22*	-.41**	+.24**	+.26**	-.29*
Katsuwonus pelamis	--	--	--	--	--
Thunnus atlanticus	--	--	--	--	--
Thunnus thynnus	--	--	--	--	--
Scomberomorus maculatus	--	--	--	--	--
Peprilus paru	--	--	--	--	--
Cubiceps pauciradiatus	--	--	--	+.41*	--
Psenes pellucidus	--	--	--	--	--
Citharichthys cornutus	+.22*	--	--	--	--
Citharichthys macrops	--	--	--	--	+.22*
Citharichthys spilopterus	+.93**	-.94**	--	+.94**	--
Citharichthys gymnorhinus	--	--	+.29**	--	-.38**

Table 55. Continued.

Species	Surface temperature	Surface salinity	Station depth	Latitude	Log plankton volume
<i>Cyclopsetta fimbriata</i>	--	--	--	--	--
<i>Etropus rimosus</i>	--	+.15*	--	--	+.23*
<i>Syacium papillosum</i>	+.37**	-.20**	--	--	--
<i>Engyrophrys senta</i>	--	--	--	--	--
<i>Monolene sessilicauda</i>	--	--	+.77**	+.76**	--
<i>Bothus robinsi</i>	+.23**	--	--	--	--
<i>Achirus lineatus</i>	--	--	--	--	--
<i>Gymnachirus melas</i>	--	--	--	--	--

Table 56. Significant correlations between the logarithm of abundance (no. under 10 m²) of 32 species of larval fishes and environmental variables in the eastern Gulf of Mexico. Data are from pooled winter (Jan-Mar) cruises, 1971-1974 (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Etrumeus teres	--	+.51**	--	+.42*
Sardinella anchovia	+.60*	--	--	--
Gonostoma elongatum	--	--	+.81**	--
Vinciguerrria nimbaria	--	--	--	--
Vinciguerrria poweriae	--	--	--	--
Notolychnus valdiviae	--	--	--	--
Myctophum nitidulum	--	--	--	--
Hygophum reinhardtii	-.78*	--	--	--
Ceratoscopelus warmingi	--	+.70*	--	--
Notoscopelus caudispinosus	--	--	--	--
Notoscopelus resplendens	--	--	--	--
Benthosema suborbitale	--	--	--	--
Diogenichthys atlanticus	--	--	--	--
Myrophis punctatus	--	--	--	--
Bregmaceros atlanticus	--	--	--	--
Bregmaceros Type A	--	+.46*	--	-.58*

Table 56. Continued.

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Bregmaceros Type B	--	+.45**	+.48**	--
Dipelctrum formosum	--	--	--	--
Centropristis striata	--	--	--	--
Hemanthias vivanus	--	+.70*	+.86**	--
Pronotogrammus aureorubens	--	--	+.55*	--
Decapterus punctatus	--	--	--	--
Trachurus lathami	--	--	--	--
Orthopristis chrysoptera	--	--	--	--
Lagodon rhomboides	--	+.29*	+.47**	--
Echiodon sp.	--	--	+.80**	--
Citharichthys cornutus	-.59*	+.87**	--	--
Citharichthys macrops	--	--	+.36	--
Citharichthys gymnorhinus	--	+.58*	--	--
Etropus rimosus	--	--	--	--
Bothus robinsi	--	+.44	--	--

Table 57. Significant correlations between the logarithm of abundance (no. under 10 m²) of 44 species of larval fishes and environmental variables in the eastern Gulf of Mexico. Data are from pooled spring (May) cruises, 1971-1974 (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Etrumeus teres	--	--	--	--
Harengula jaguana	--	--	--	--
Opisthonema oglinum	+.19*	+.28**	--	--
Sardinella anchovia	--	--	--	--
Gonostoma elongatum	--	--	--	+.94*
Maurollicus muelleri	--	--	--	--
Vinciguerrria nimbaria	--	--	--	--
Vinciguerrria poweriae	--	--	--	--
Vinciguerrria attenuata	--	--	--	--
Notolychnus valdiviae	--	--	--	--
Lampadena luminosa	--	--	--	+.85*
Lampanyctus alatus	-.76*	--	--	--
Lampanyctus cuprarius	--	--	--	--
Myctophum nitidulum	--	--	--	--
Myctophum selenops	--	--	+.68*	--
Hygophum reinhardtii	--	--	--	--

Table 57. Continued.

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
<i>Ceratoscopelus warmingi</i>	--	--	--	--
<i>Centrobranchus nigroocellatus</i>	--	--	--	--
<i>Benthoosema suborbitale</i>	--	--	+ .51**	--
<i>Diogenichthys atlanticus</i>	--	--	--	--
<i>Bregmaceros atlanticus</i>	--	--	--	--
<i>Bregmaceros</i> Type A	--	--	--	+ .63*
<i>Bregmaceros</i> Type B	--	- .43**	--	--
<i>Bregmaceros maclellandi</i>	--	--	--	--
<i>Sphyraena borealis</i>	+ .75**	--	--	--
<i>Diplectrum formosum</i>	- .19*	--	--	+ .26*
<i>Centropristis striata</i>	--	--	--	--
<i>Hemanthias vivanus</i>	--	--	--	--
<i>Pronotoqrammus aureorubens</i>	+ .59*	- .47*	--	--
<i>Serraniculus pumilio</i>	--	--	--	--
<i>Decapterus punctatus</i>	--	--	--	--
<i>Orthopristis chrysoptera</i>	- .50**	--	--	+ .70*
<i>Cynoscion nebulosus</i>	--	--	--	--
<i>Leiostomus xanthurus</i>	--	--	--	--

Table 57. Continued.

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Echiodon sp.	--	--	--	--
Auxis sp.	--	--	--	--
Euthynnus alletteratus	--	--	--	--
Cubiceps pauciradiatus	--	--	--	--
Citharichthys cornutus	--	--	--	--
Citharichthys macrops	--	--	+.25*	--
Citharichthys gymnorhinus	--	+.36*	--	--
Etropus rimosus	--	--	--	+.40
Syacium papillosum	--	--	--	--
Bothus robinsi	--	+.30**	--	--

Table 58. Significant correlations between the logarithm of abundance (no. under 10 m²) of 25 species of larval fishes and environmental variables in the eastern Gulf of Mexico. Data are from pooled early summer (June-July) cruises, 1971-1974 (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Harengula jaguana	--	--	--	--
Opisthonema oglinum	--	+.41**	--	+.39*
Sardinella anchovia	--	--	--	--
Maurolicus muelleri	--	--	--	--
Vinciguerria nimbaria	--	--	--	-.77*
Notolychnus valdiviae	--	+.80*	--	--
Myctophum nitidulum	--	-.83**	--	--
Hygophum reinhardtii	--	--	--	--
Benthoosema suborbitale	--	--	--	--
Diogenichthys atlanticus	--	--	--	--
Bregmaceros atlanticus	--	--	--	--
Bregmaceros Type B	--	--	--	--
Diplectrum formosum	--	--	--	--
Serraniculus pumilio	--	--	--	+.63*
Decapterus punctatus	--	--	--	--
Echiodon sp.	--	--	--	--

Table 58. Continued.

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Auxis sp.	--	--	--	--
Euthynnus alletteratus	--	-.52**	+.55**	--
Thunnus atlanticus	--	--	--	--
Citharichthys cornutus	--	--	--	--
Citharichthys macrops	--	-.57*	--	--
Citharichthys gymnorhinus	--	--	--	--
Cyclopsetta fimbriata	--	-.64*	+.89**	--
Syacium papillosum	--	-.38**	+.42**	--
Bothus robinsi	--	--	--	--

Table 59. Significant correlations between the logarithm of abundance (no. under 10 m²) of 44 species of larval fishes and environmental variables in the eastern Gulf of Mexico. Data are from pooled late summer (Aug-Sept) cruises, 1971-1974 (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Harengula jaguana	--	-.59**	--	--
Opisthonema oglinum	--	--	--	--
Sardinella anchovia	----	--	--	--
Gonostoma elongatum	--	--	--	--
Maurollicus muelleri	--	--	--	--
Vinciguerria nimbaria	+.53*	--	--	--
Vinciguerria poweriae	--	--	--	--
Vinciguerria attenuata	--	--	--	--
Notolychnus valdiviae	--	--	--	--
Lampadena luminosa	--	--	+.61*	--
Lampanyctus alatus	--	--	--	--
Myctophum nitidulum	--	--	--	--
Myctophum selenops	--	--	+.80**	--
Ceratoscopelus warmingi	--	--	--	--
Centrobranchus nigroocellatus	--	--	--	--
Benthosema suborbitale	--	--	--	--

Table 59. Continued.

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Diogenichthys atlanticus	--	--	--	--
Gymnothorax nigromarginatus	--	--	--	-.71*
Paraconger caudilimbatus	--	--	--	--
Hildebrandia gracilior	--	--	--	--
Bregmaceros atlanticus	--	--	--	--
Bregmaceros Type A	-.54**	--	--	--
Bregmaceros Type B	--	--	--	--
Bregmaceros maclellandi	--	--	+.83*	--
Sphyraena barracuda	--	--	--	--
Diplectrum formosum	--	--	+.23	--
Serraniculus pumilio	--	--	--	--
Chloroscombrus chrysurus	--	--	--	--
Decapterus punctatus	-.21**	+.16*	--	-.25*
Selene vomer	--	--	--	--
Echiodon sp.	--	--	--	--
Auxis sp.	--	-.36**	--	-.56**
Euthynnus alletteratus	--	-.39**	+.25*	-.49**
Thunnus atlanticus	--	--	--	--

Table 59. Continued.

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Cubiceps pauciradiatus	--	--	--	--
Citharichthys cornutus	--	--	--	--
Citharichthys macrops	-.45*	--	+.36*	--
Citharichthys gymnorhinus	--	--	--	--
Cyclopsetta fimbriata	--	--	--	--
Syacium papillosum	--	--	--	--
Bothus robinsi	--	--	--	--

Table 60. Significant correlations between the logarithm of abundance (no. under 10 m²) of 32 species of larval fishes and environmental variables in the eastern Gulf of Mexico. Data are from pooled fall (Nov) cruises, 1971-1974 (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Etrumeus teres	--	--	--	--
Sardinella anchovia	--	--	--	--
Gonostoma elongatum	+.71**	--	--	--
Maurolicus muelleri	--	--	--	--
Vinciguerrria nimbaria	--	--	+.69**	--
Vinciguerrria poweriae	--	--	--	--
Notolychnus valdiviae	--	--	--	--
Lampanyctus alatus	--	--	--	--
Myctophum nitidulum	--	--	--	--
Myctophum selenops	--	--	--	--
Hygophum reinhardti	--	--	--	--
Ceratoscopelus warmingi	--	--	--	--
Centrobranchus nigroocellatus	--	--	--	--
Benthosema suborbitale	+.57**	--	--	--
Diogenichthys atlanticus	--	--	--	-.71*
Myrophis punctatus	--	--	--	--

Table 60. Continued.

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Bregmaceros atlanticus	--	--	--	--
Bregmaceros Type A	+.49*	--	--	--
Bregmaceros Type B	--	--	--	--
Diplectrum formosum	--	--	+.49**	--
Centropristis striata	--	--	--	--
Hemanthias vivanus	--	--	--	--
Serraniculus pumilio	--	--	--	--
Decapterus punctatus	+.31**	+.21*	--	--
Leiostomus xanthurus	--	--	--	--
Echiodon sp.	--	--	--	--
Citharichthys cornutus	--	--	--	--
Citharichthys macrops	--	--	--	--
Citharichthys gymnorhinus	+.56**	--	+.51*	-.59**
Etropus rimosus	--	--	--	--
Syacium papillosum	+.43**	--	--	-.27*
Bothus robinsi	+.32**	+.21*	--	--

Table 61. Cruise GE 7101. Significant correlations between the logarithm of abundance (no. under 10 m²) of 11 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth
Etrumeus teres	--	--	--
Bregmaceros Type A	+.87*	--	--
Bregmaceros Type B	--	--	+.80*
Diplectrum formosum	--	--	--
Decapterus punctatus	--	--	--
Trachurus lathami	+.66*	--	--
Orthopristis chrysoptera	--	--	--
Lagodon rhomboides	--	--	--
Citharichthys macrops	--	--	--
Etropus rimosus	--	--	--
Bothus robinsi	--	--	--

Table 62. Cruise 8C 7113-TI 7114. Significant correlations between the logarithm of abundance (no. under 10 m²) of 26 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth
Etrumeus teres	--	--	--
Harengula jaguana	--	--	-.63*
Opisthonema oglinum	--	--	-.38**
Sardinella anchovia	--	--	--
Vinciguerrria nimbaria	--	--	--
Vinciguerrria poweriae	--	--	--
Notolychnus valdiviae	--	--	--
Myctophum nitidulum	--	--	+.66**
Ceratoscopelus warmingi	--	--	--
Benthoosema suborbitale	--	--	--
Diogenichthys altanticus	--	--	--
Bregmaceros Type A	--	--	+.60**
Bregmaceros Type B	--	-.57**	+.41*
Diplectrum formosum	-.30**	--	--
Centropristis striata	--	--	--
Hemanthias vivanus	--	-.50*	--
Serraniculus pumilio	--	--	--

Table 62. Continued.

Species	Surface temperature	Surface salinity	Station depth
Decapterus punctatus	--	--	--
Orthopristis chrysoptera	--	--	--
Echiodon sp.	--	--	--
Citharichthys cornutus	--	--	+.51**
Citharichthys macrops	--	--	--
Citharichthys gymnorhinus	--	--	--
Etropus rimosus	--	--	--
Syacium papillosum	--	--	--
Bothus robinsi	--	--	--

Table 63. Cruise GE 7117. Significant correlations between the logarithm of abundance (no. under 10 m²) of 7 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth
Opisthonema oglinum	--	--	--
Bregmaceros Type B	--	--	--
Diplectrum formosum	--	--	--
Decapterus punctatus	-.61*	--	--
Euthynnus alletteratus	--	--	--
Syacium papillosum	--	--	--
Bothus robinsi	--	--	--

Table 64. Cruise 8C 7120-TI 7121. Significant correlations between the logarithm of abundance (no. under 10 m²) of 29 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth
Harengula jaguana	--	--	--
Opisthonema oglinum	--	--	--
Sardinella anchovia	--	--	-.38*
Gonostoma elongatum	--	--	--
Maurolicus muelleri	--	--	--
Vinciguerria nimbaria	+.56*	--	+.55*
Notolychnus valdiviae	--	--	--
Myctophum nitidulum	--	--	--
Myctophum Selenops	--	--	+.81**
Benthoosema suborbitale	--	--	--
Gymnothorax nigromarginatus	--	--	--
Paraconger caudilimbatus	--	--	--
Bregmaceros Type A	-.72**	--	--
Bregmaceros Type B	--	--	--
Diplectrum formosum	--	--	--
Serraniculus pumilio	--	--	--
Chloroscombrus chrysurus	--	--	-.40*

Table 64. Continued.

Species	Surface temperature	Surface salinity	Station depth
Decapterus punctatus	--	--	--
Echiodon sp.	--	--	--
Auxis sp.	--	-.50**	--
Euthynnus alletteratus	--	-.58**	+.31*
Thunnus atlanticus	--	--	--
Cubiceps pauciradiatus	--	--	--
Citharichthys cornutus	--	--	--
Citharichthys macrops	--	--	--
Citharichthys gymnorhinus	--	--	--
Cyclopsetta fimbriata	--	--	--
Syacium papillosum	--	--	--
Bothus robinsi	--	--	--

Table 65. Cruise TI 7131-8B 7132. Significant correlations between the logarithm of abundance (no. under 10 m²) of 22 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth
Etrumeus teres	--	--	--
Sardinella anchovia	--	--	--
Gonostoma elongatum	--	--	--
Maurolicus muelleri	--	--	--
Vinciguerria poweriae	--	--	--
Notolychnus valdiviae	--	--	--
Myctophum nitidulum	--	--	--
Benthoosema suborbitale	--	--	--
Diogenichthys atlanticus	--	--	--
Bregmaceros atlanticus	+.70*	--	--
Bregmaceros Type A	--	--	--
Bregmaceros Type B	--	--	--
Diplectrum formosum	--	--	--
Hemanthias vivanus	--	--	--
Decapterus punctatus	--	--	--
Echiodon sp.	--	--	--
Citharichthys cornutus	--	--	--

Table 65. Continued.

Species	Surface temperature	Surface salinity	Station depth
Citharichthys macrops	--	--	--
Citharichthys gymnorhinus	--	--	--
Etropus rimosus	--	--	--
Syacium papillosum	--	--	--
Bothus robinsi	-.47*	--	--

Table 66. Cruise 8B 7201-GE 7202. Significant correlations between the logarithm of abundance (no. under 10 m²) of 8 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Etrumeus teres	--	--	--	+.64*
Bregmaceros Type A	--	--	--	--
Bregmaceros Type B	--	--	--	--
Diplectrum formosum	--	--	--	--
Decapterus punctatus	--	--	--	--
Trachurus lathami	--	--	--	--
Orthopristis chrysoptera	--	--	--	--
Lagodon rhomboides	--	--	--	--

Table 67. Cruise GE 7208. Significant correlations between the logarithm of abundance (no. under 10 m²) of 20 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Opisthonema oglinum	--	--	--	--
Sardinella anchovia	--	--	--	--
Vinciguerria nimbaria	--	--	--	--
Vinciguerria poweriae	--	--	--	--
Notolychnus valdiviae	--	--	--	--
Myctophum nitidulum	--	--	--	--
Ceratoscopelus warmingi	+.91**	--	--	--
Benthoosema suborbitale	--	--	--	--
Diogenichthys atlanticus	--	--	--	--
Bregmaceros Type A	--	--	--	--
Bregmaceros Type B	--	--	--	--
Diplectrum formosum	--	+.52*	--	--
Hemanthias vivanus	--	--	--	--
Serraniculus pumilio	--	+.82*	--	--
Decapterus punctatus	--	+.53*	--	--
Citharichthys cornutus	--	--	--	--
Citharichthys macrops	--	--	--	--

Table 67. Continued.

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Etropus rimosus	--	--	--	--
Syacium papillosum	--	+.54*	--	--
Bothus robinsi	--	--	--	--

Table 68. Cruise GE 7210. Significant correlations between the logarithm of abundance (no. under 10 m²) of 4 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Opisthonema oglinum	--	--	+.72*	+.70*
Diplectrum formosum	--	--	--	--
Decapterus punctatus	--	--	--	--
Syacium papillosum	--	--	+.79	--

Table 69. Cruise IS 7205. Significant correlations between the logarithm of abundance (no. under 10 m²) of 13 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
<i>Sardinella anchovia</i>	--	--	--	--
<i>Gymnothorax nigromarginatus</i>	--	--	--	--
<i>Bregmaceros Type B</i>	--	--	--	--
<i>Diplectrum formosum</i>	--	--	--	--
<i>Serraniculus pumilio</i>	--	+.49*	--	--
<i>Chloroscombrus chrysurus</i>	--	--	--	--
<i>Decapterus punctatus</i>	--	--	+.60**	--
<i>Auxis sp.</i>	--	--	--	--
<i>Euthynnus alletteratus</i>	--	--	+.72**	--
<i>Citharichthys macrops</i>	--	--	--	--
<i>Cyclopsetta fimbriata</i>	--	-.63*	--	--
<i>Syacium papillosum</i>	+.51**	--	+.38*	--
<i>Bothus robinsi</i>	+.42*	--	--	--

Table 70. Cruise IS 7209. Significant correlations between the logarithm of abundance (no. under 10 m²) of 12 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Benthosema suborbitale	--	--	--	--
Bregmaceros Type A	--	--	--	--
Bregmaceros Type B	--	--	--	--
Diplectrum formosum	--	--	--	--
Hemanthias vivanus	--	--	+.95*	--
Decapterus punctatus	+.75**	+.55**	+.47*	--
Echiodon sp.	--	--	--	--
Citharichthys macrops	--	--	--	--
Citharichthys gymnorhinus	+.74*	+.77**	--	-.77**
Etropus rimosus	--	--	--	--
Syacium papillosum	+.61**	--	--	-.52**
Bothus robinsi	+.54**	--	--	--

Table 71. Cruise IS 7303. Significant correlations between the logarithm of abundance (no. under 10 m²) of 11 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Etrumeus teres	--	+.71**	--	--
Bregmaceros Type A	+.76**	--	--	-.84**
Bregmaceros Type B	+.62**	--	--	--
Diplectrum formosum	--	--	--	--
Decapterus punctatus	--	--	--	--
Trachurus lathami	--	--	--	--
Orthopristis chryoptera	+.63*	+.79**	--	--
Lagodon rhomboides	+.54**	+.60**	+.56**	--
Citharichthys macrops	--	--	--	--
Etropus rimosus	--	+.39	--	--
Bothus robinsi	+.67**	+.57**	--	--

Table 72. Cruise IS 7308. Significant correlations between the logarithm of abundance (no. under 10 m²) of 18 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Harengula jaguana	--	--	--	--
Opisthonema oglinum	+.49*	--	--	--
Sardinella anchovia	--	--	--	--
Notolychnus valdiviae	--	--	--	--
Myctophum nitidulum	--	--	--	--
Benthoosema suborbitale	--	--	--	--
Bregmaceros Type A	--	--	--	--
Bregmaceros Type B	--	--	--	--
Diplectrum formosum	--	--	--	--
Serraniculus pumilio	--	--	+.68*	--
Decapterus punctatus	+.39*	--	--	--
Orthopristis chrysoptera	--	--	--	--
Citharichthys cornutus	--	--	--	--
Citharichthys macrops	--	--	+.59**	--
Citharichthys gymnorhinus	--	--	--	--
Etropus rimosus	--	+.61*	--	--

Table 72. Continued.

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Syacium papillosum	--	--	--	--
Bothus robinsi	--	+ .51**	--	--

Table 73. Cruise IS 7311. Significant correlations between the logarithm of abundance (no. under 10 m²) of 9 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Opisthonema oglinum	--	+.53*	+.48*	--
Bregmaceros Type B	--	--	--	--
Diplectrum formosum	--	--	--	--
Serraniculus pumilio	--	--	--	+.67*
Decapterus punctatus	--	--	--	--
Euthynnus alletteratus	--	-.82**	+.71**	--
Citharichthys macrops	--	-.71	+.79	--
Syacium papillosum	+.39*	-.51**	+.37*	--
Bothus robinsi	--	--	--	--

Table 74. Cruise IS 7313. Significant correlations between the logarithm of abundance (no. under 10 m²) of 20 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Harengula jaguana	--	-.62*	--	--
Opisthonema oglinum	--	--	--	--
Sardinella anchovia	--	--	--	--
Maurolicus muelleri	--	--	--	--
Myctophum nitidulum	--	--	--	--
Benthoosema suborbitale	--	--	--	--
Bregmaceros Type B	--	--	--	--
Diplectrum formosum	--	--	+.47*	--
Serraniculus pumilio	--	--	+.63*	--
Chloroscombrus chrysurus	--	--	--	--
Decapterus punctatus	--	+.40*	--	-.54**
Echiodon sp.	--	--	--	--
Auxis sp.	--	--	+.61	-.72**
Euthynnus alletteratus	--	-.43*	--	-.60**
Thunnus atlanticus	--	--	--	--
Citharichthys macrops	--	--	--	--

Table 74. Continued.

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Citharichthys gymnorhinus	--	--	--	--
Cyclopsetta fimbriata	--	--	+.96**	--
Syacium papillosum	--	--	--	--
Bothus robinsi	--	--	+.40*	+.41*

Table 75. Cruise IS 7320. Significant correlations between the logarithm of abundance (no. under 10 m²) of 18 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
<i>Etrumeus teres</i>	--	--	--	--
<i>Sardinella anchovia</i>	+.91*	--	--	--
<i>Gonostoma elongatum</i>	--	--	--	--
<i>Maurolicus muelleri</i>	--	--	--	--
<i>Vinciguerrria poweriae</i>	--	--	--	--
<i>Notolychnus valdiviae</i>	+.90**	+.75*	+.75**	--
<i>Benthoosema suborbitale</i>	--	--	--	--
<i>Diogenichthys atlanticus</i>	--	--	--	-.80
<i>Bregmaceros</i> Type B	--	--	--	--
<i>Diplectrum formosum</i>	--	--	+.78**	--
<i>Decapterus punctatus</i>	+.47**	--	+.51**	--
<i>Echiodon</i> sp.	--	--	+.58*	--
<i>Citharichthys cornutus</i>	--	-.89**	--	--
<i>Citharichthys macrops</i>	--	--	--	--
<i>Citharichthys gymnorhinus</i>	--	--	--	--
<i>Etropus rimosus</i>	--	--	--	--

Table 75. Continued.

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Syacium papillosum	+.71**	+.45*	--	--
Bothus robinsi	+.66**	+.47**	+.36*	--

Table 76. Cruise CL 7405. Significant correlations between the logarithm of abundance (no. under 10 m²) of 4 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Diplectrum formosum	--	--	--	--
Orthopristis chrysoptera	--	--	--	--
Lagodon rhomboides	--	--	+.90*	--
Citharichthys macrops	--	--	--	--

Table 77. Cruise CL 7412. Significant correlations between the logarithm of abundance (no. under 10 m²) of 11 species of larval fishes and environmental variables in the eastern Gulf of Mexico (* P < .05; ** P < .01).

Species	Surface temperature	Surface salinity	Station depth	Log plankton volume
Harengula jaguana	--	--	--	--
Opisthonema oglinum	+.50*	+.55**	--	--
Sardinella anchovia	--	--	--	+.51*
Bregmaceros Type B	--	--	--	--
Diplectrum formosum	--	--	+.61**	--
Serraniculus pumilio	--	--	--	--
Decapterus punctatus	--	--	+.51**	--
Citharichthys macrops	--	--	--	--
Etropus rimosus	--	--	--	--
Syacium papillosum	--	--	+.91**	--
Bothus robinsi	--	--	+.65*	--

Table 78. The percentage cumulative frequencies of station occurrences for the 20 most often sampled, identified species of fish larvae collected on 17 cruises to the eastern Gulf of Mexico, 1971-1974, in relation to surface temperature, surface salinity and station depth.

Family	Species	Station Occurrences--Percentage Cumulative Frequencies		
		Surface temperature (°C)	Surface salinity (‰)	Station depth (m)
Clupeidae	<i>Sardinella anchovia</i>	21.0-23.9-- 18%	27.0-28.9-- 1%	<10-- 6%
		24.0-26.9-- 46%	29.0-30.9-- 1%	11- 30-- 56%
		27.0-29.9-- 80%	31.0-32.9-- 2%	31- 50-- 90%
		30.0-32.0--100%	33.0-34.9-- 16%	51- 70-- 96%
			35.0-36.9--100%	71- 146--100%
Clupeidae	<i>Opisthonema oglinum</i>	18.0-20.9-- 3%	27.0-28.9-- 1%	<10-- 13%
		21.0-23.9-- 15%	29.0-30.9-- 1%	11- 30-- 77%
		24.0-26.9-- 60%	31.0-32.9-- 5%	31- 50-- 96%
		27.0-29.9-- 88%	33.0-34.9-- 15%	51- 101--100%
		30.0-31.9--100%	35.0-36.9-- 95%	
			>37.0--100%	
Carangidae	<i>Decapterus punctatus</i>	20.0-22.9-- 3%	27.0-28.9-- <1%	<10-- 3%
		23.0-25.9-- 46%	29.0-30.9-- 1%	11- 30-- 38%
		26.0-28.9-- 66%	31.0-32.9-- 4%	31- 50-- 68%
		29.0-31.9-->99%	33.0-34.9-- 15%	51- 70-- 87%
		>32.0--100%	35.0-36.9-- 99%	71- 90-- 90%
			>37.0--100%	91-3,292--100%
Serranidae	<i>Diplectrum formosum</i>	17.0-19.9-- 1%	31.0-32.9-- 1%	<10-- 2%
		20.0-22.9-- 9%	33.0-34.9-- 13%	11- 30-- 50%
		23.0-25.9-- 54%	35.0-36.9-- 99%	31- 50-- 84%
		26.0-28.9-- 72%	>37.0--100%	51- 70-- 97%
		29.0-31.9-->99%		71- 155--100%
		>32.0--100%		

Table 78. Continued.

Family	Species	Station Occurrences--Percentage Cumulative Frequencies		
		Surface temperature (°C)	Surface salinity (‰)	Station depth (m)
Clupeidae	Harengula jaguana	18.0-20.9-- 6%	27.0-28.9-- 1%	<10-- 29%
		21.0-23.9-- 19%	29.0-30.9-- 2%	11- 30-- 92%
		24.0-26.9-- 62%	31.0-32.9-- 9%	31- 50-- 97%
		27.0-29.9-- 82%	33.0-34.9-- 31%	51- 155--100%
		30.0-30.9--100%	35.0-36.0-- 96%	
			>37.0--100%	
Bothidae	Syacium papillosum	19.0-21.9-- 1%	25.0-26.9-- <1%	<10-- <1%
		22.0-24.9-- 17%	27.0-28.9-- 1%	11- 30-- 18%
		25.0-27.9-- 47%	29.0-30.9-- 1%	31- 50-- 51%
		28.0-30.9-- 99%	31.0-32.9-- 6%	51- 70-- 75%
		31.0-32.0--100%	33.0-34.9-- 15%	71- 90-- 79%
			35.0-36.9-- 99%	91- 110-- 83%
			>37.0--100%	111- 130-- 86%
				131- 170-- 93%
				171-1,000-- 99%
				>1,001--100%
Bregmacerotidae	Bregmaceros Type B	19.0-21.9-- 6%	25.0-26.9-- 1%	11- 30-- 4%
		22.0-24.9-- 29%	27.0-28.9-- 1%	31- 50-- 36%
		25.0-27.9-- 63%	29.0-30.9-- 1%	51- 70-- 74%
		28.0-30.9--100%	31.0-32.9-- 8%	71- 90-- 80%
			33.0-34.9-- 14%	91- 110-- 85%
			35.0-36.9-->99%	111- 150-- 89%

Table 78. Continued.

Family	Species	Station Occurrences--Percentage Cumulative Frequencies		
		Surface temperature (°C)	Surface salinity (‰)	Station depth (m)
Bothidae	<i>Bothus robinsi</i>		>37.0--100%	151- 200-- 96%
				201-1,000-- 99%
				>1,001--100%
		17.0-19.9-- 2%	25.0-26.9-- <1%	<10-- 1%
		20.0-22.9-- 7%	27.0-28.9-- 1%	11- 30-- 18%
		23.0-25.9-- 37%	29.0-30.9-- 1%	31- 50-- 49%
		26.0-28.9-- 60%	31.0-32.9-- 5%	51- 70-- 74%
		29.0-31.9-->99%	33.0-34.9-- 13%	71- 90-- 78%
		>32.0--100%	35.0-36.9-- 99%	91- 110-- 82%
			>37.0--100%	111- 130-- 84%
Bothidae	<i>Etropus rimosus</i>			131- 170-- 93%
				171-1,000-- 99%
				>1,0001--100%
		16.0-18.9-- 6%	31.0-32.9-- 1%	<10-- 2%
		19.0-21.9-- 14%	33.0-34.9-- 12%	11- 30-- 25%
		22.0-24.9-- 55%	35.0-36.9-->99%	31- 50-- 64%
		25.0-27.9-- 90%	>37.0--100%	51- 70-- 89%
		28.0-30.9--100%		71- 90-- 92%
				91- 110-- 96%
				111- 329--100%

Table 78. Continued.

Family	Species	Station Occurrences--Percentage Cumulative Frequencies		
		Surface temperature (°C)	Surface salinity (°/oo)	Station depth (m)
Gonostomatidae	Maurolicus muelleri	21.0-23.9-- 6%	23.0-24.9-- 1%	31- 50-- 2%
		24.0-26.9-- 38%	25.0-26.9-- 2%	51- 70-- 5%
		27.0-29.9-- 85%	27.0-28.9-- 5%	71- 90-- 10%
		30.0-30.9--100%	29.0-30.9-- 5%	91- 110-- 15%
			31.0-32.9-- 20%	111- 130-- 20%
			33.0-34.9-- 27%	131- 170-- 63%
			35.0-36.9--100%	171- 500-- 84%
				501-1,000-- 93%
				≥1,001--100%
Clupeidae	Etrumeus teres	17.0-19.9-- 6%	34.0-35.9-- 19%	11- 30-- 8%
		20.0-22.9-- 28%	36.0-36.9--100%	31- 50-- 39%
		23.0-25.9-- 87%		51- 70-- 70%
		26.0-27.9--100%		71- 90-- 77%
				91- 110-- 86%
				111- 130-- 87%
				131- 170-- 98%
				171- 823--100%
Bregmacerotidae	Bregmaceros Type A	21.0-23.9-- 15%	32.0-33.9-- 4%	11- 30-- 2%
		24.0-26.9-- 61%	34.0-35.9-- 27%	31- 50-- 6%
		27.0-29.9-- 99%	36.0-36.9--100%	51- 70-- 27%
		30.0-30.9--100%		71- 90-- 40%
				91- 110-- 58%
				111- 150-- 78%

Table 78. Continued.

Family	Species	Station Occurrences--Percentage Cumulative Frequencies		
		Surface temperature (°C)	Surface salinity (‰)	Station depth (m)
				151- 200-- 89% 201-1,000-- 97% ≥1,001--100%
Carangidae	<i>Chloroscombrus chrysurus</i>	24.0-26.9-- 11%	27.0-28.9-- 1%	<10-- 14%
		27.0-29.9-- 64%	29.0-30.9-- 1%	11- 30-- 93%
		30.0-31.9--100%	31.0-32.9-- 6%	31- 40--100%
			33.0-34.9-- 11%	
			35.0-36.9-- 94%	
			37.0-37.9--100%	
Pomadasyidae	<i>Orthopristis chrysoptera</i>	15.0-17.9-- 16%	30.0-31.9-- 4%	<10-- 16%
		18.0-20.9-- 48%	32.0-33.9-- 22%	11- 30-- 96%
		21.0-23.9-- 75%	34.0-35.9-- 71%	31--100%
		24.0-25.9--100%	36.0-36.9--100%	
Bothidae	<i>Citharichthys cornutus</i>	21.0-23.9-- 13%	25.0-26.9-- 1%	11- 30-- 3%
		24.0-26.9-- 58%	27.0-28.9-- 1%	31- 50-- 8%
		27.0-29.9-- 92%	29.0-30.9-- 1%	51- 70-- 19%
		30.0-30.9--100%	31.0-32.9-- 7%	71- 90-- 30%
			33.0-34.9-- 13%	91- 110-- 45%
			35.0-36.9--100%	111- 150-- 66%
				151- 200-- 86%
				201-1,000-- 99% ≥1,001--100%

Table 78. Continued.

Family	Species	Station Occurrences--Percentage Cumulative Frequencies		
		Surface temperature (°C)	Surface salinity (‰)	Station depth (m)
Bothidae	<i>Citharichthys macrops</i>	17.0-19.9-- 4%	27.0-28.9-- 1%	<10-- 4%
		20.0-22.9-- 18%	29.0-30.9-- 1%	11- 30-- 76%
		23.0-25.9-- 64%	31.0-32.9-- 4%	31- 50-- 96%
		26.0-28.9-- 81%	33.0-34.9-- 18%	51- 70-- 98%
		29.0-30.9--100%	35.0-36.9-- 97%	71-3,384--100%
			37.0-37.9--100%	
Myctophidae	<i>Myctophum nitidulum</i>	18.0-20.9-- 1%	23.0-24.9-- 1%	11- 30-- 1%
		21.0-23.9-- 10%	25.0-26.9-- 2%	31- 50-- 3%
		24.0-26.9-- 47%	27.0-28.9-- 3%	51- 70-- 16%
		27.0-29.9-- 84%	29.0-30.9-- 3%	71- 90-- 21%
		30.0-30.9--100%	31.0-32.9-- 16%	91- 110-- 30%
			33.0-34.9-- 29%	111- 150-- 49%
			35.0-36.9--100%	151- 200-- 68%
				201-1,000-- 89%
Serranidae	<i>Hemanthias vivanus</i>			>1,001--100%
		22.0-24.9-- 25%	31.0-32.9-- 1%	11- 30-- 4%
		25.0-27.9-- 84%	33.0-34.9-- 4%	31- 50-- 6%
		28.0-30.9--100%	35.0-36.9--100%	51- 70-- 27%
				71- 90-- 37%
				91- 110-- 48%
				111- 150-- 73%
				151- 200-- 87%
				201- 677--100%

Table 78. Continued.

Family	Species	Station Occurrences--Percentage Cumulative Frequencies		
		Surface temperature (°C)	Surface salinity (‰)	Station depth (m)
Serranidae	<i>Serraniculus pumilio</i>	22.0-24.9-- 24%	33.0-34.9-- 13%	<10-- 4%
		25.0-27.9-- 46%	35.0-36.9-- 98%	11- 30-- 74%
		28.0-30.9-- 99%	37.0-37.9--100%	31- 50-- 97%
		<u>>31.0--100%</u>		51- 70-- 99%
				71- 155--100%
Scombridae	<i>Euthynnus alletteratus</i>	24.0-26.9-- 8%	23.0-24.9-- 1%	11- 30-- 10%
		27.0-29.9-- 74%	25.0-26.9-- 2%	31- 50-- 33%
		30.0-30.9--100%	27.0-28.9-- 4%	51- 70-- 60%
			29.0-30.9-- 5%	71- 90-- 67%
			31.0-32.9-- 20%	91- 110-- 71%
			33.0-34.9-- 35%	111- 150-- 77%
			35.0-36.9--100%	151- 200-- 87%
				201-1,000-- 97%
				<u>>1,001--100%</u>

Table 79. Observed and expected frequencies of occurrence for 14 species of larval fishes from the eastern Gulf of Mexico in the <50 and 50-100 m depth zones for areas where $\geq 36.5^{\circ}/\text{oo}$ salinity water was present. Data are part of a contingency chi-square analysis in which adjusted observed frequencies (adjusted to 1,000 stations sampled) in three depth zones (< 50 m, 50-100 m, and > 100 m) were tested for independence of occurrence between two salinity conditions (< $36.5^{\circ}/\text{oo}$ and $\geq 36.5^{\circ}/\text{oo}$ --Loop Current).

Species	Occurrences at $\geq 36.5^{\circ}/\text{oo}$ for <50 and 50-100 m depths		Total Chi-square ^a	Chi-square component for <50 and 50-100 m depths
	Adjusted observed frequencies	Expected frequencies		
Hemanthias vivanus	125	122.62	3.12 n.s.	3.08
Bregmaceros atlanticus	188	144.40	44.51 **	36.45
Bregmaceros maclellandi	0	9.21	59.74 **	56.60
Bregmaceros Type A	375	370.67	16.42 **	16.31
Bregmaceros Type B	655	735.97	81.13 **	41.07
Diogenichthys atlanticus	31	19.95	10.37 **	9.81
Benthoosema suborbitale	63	59.94	0.32 n.s.	0.29
Notolychnus valdiviae	31	54.37	25.69 **	23.33
Myctophum nitidulum	281	214.45	64.61 **	51.15

Table 79. Continued.

Species	Occurrences at $\geq 36.5^{\circ}$ /oo for <50-100 m depths		Total Chi-square ^a	Chi-square component for <50 and 50-100 m depths
	Adjusted observed frequencies	Expected frequencies		
Diaphus spp.	530	510.98	2.48 n.s.	1.72
Maurolicus muelleri	63	60.82	0.18 n.s.	0.16
Gonostoma elongatum	31	21.15	9.74 **	9.24
Vinciguerrria nimbaria	125	121.09	6.24 *	6.17
Auxis sp.	250	262.02	35.53 **	34.80

^a n.s. = not significant; * = $P < .05$; ** = $P < .01$.

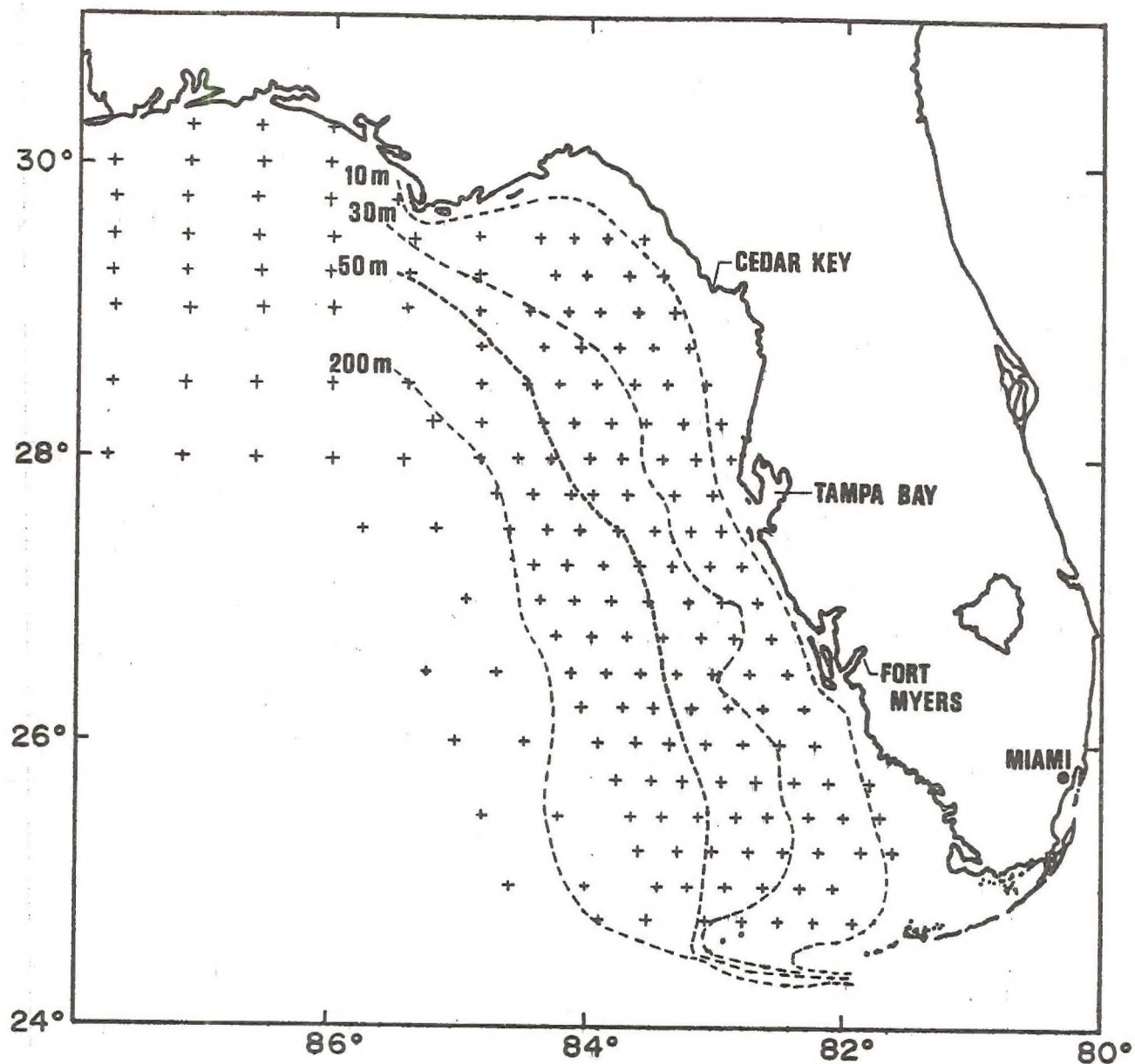


Fig. 1

Chart of eastern Gulf of Mexico ichthyoplankton survey area, with potential sampling stations and depth contours indicated.

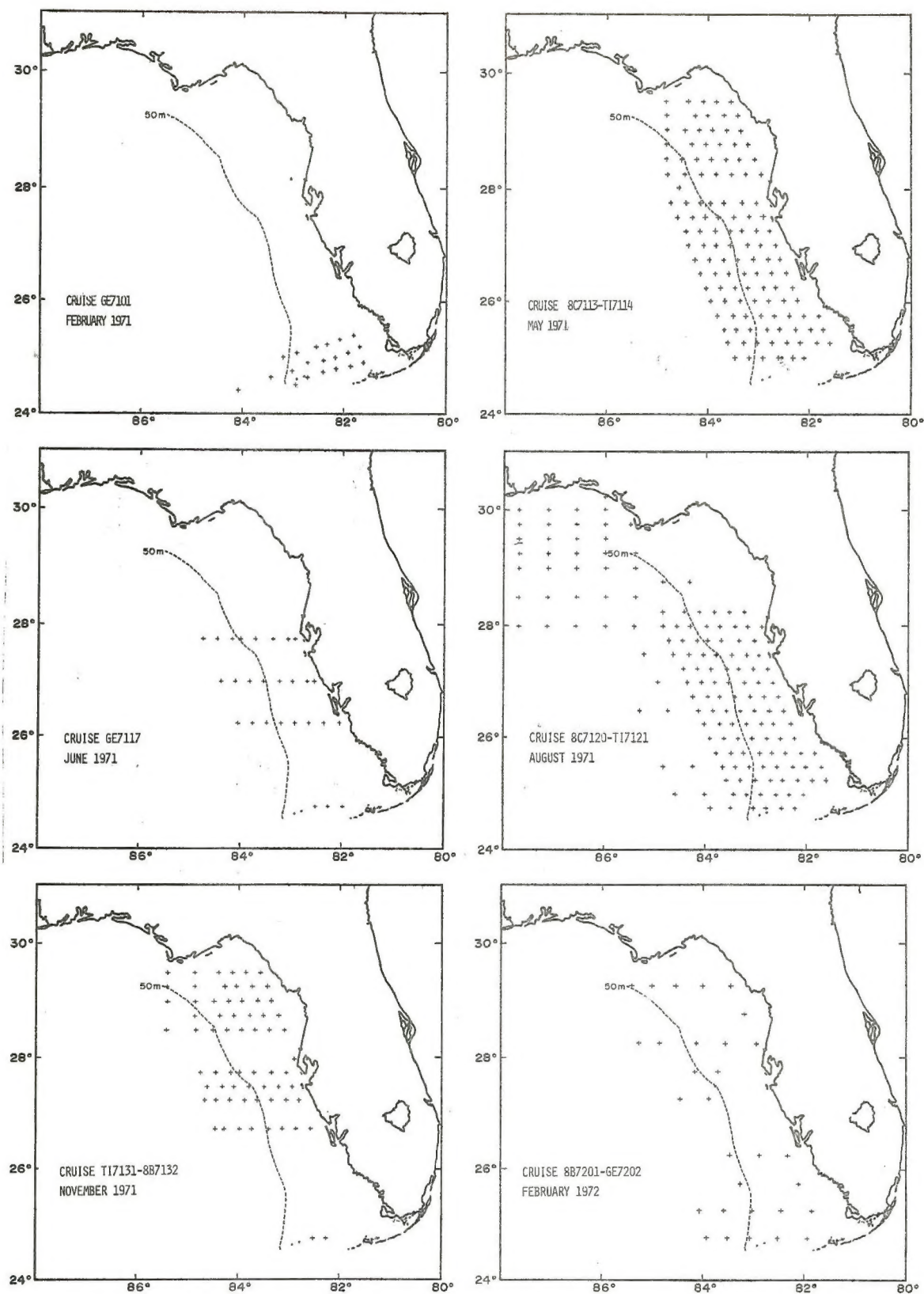


Fig. 2 Ichthyoplankton sampling stations, eastern Gulf of Mexico, 1971-1974.

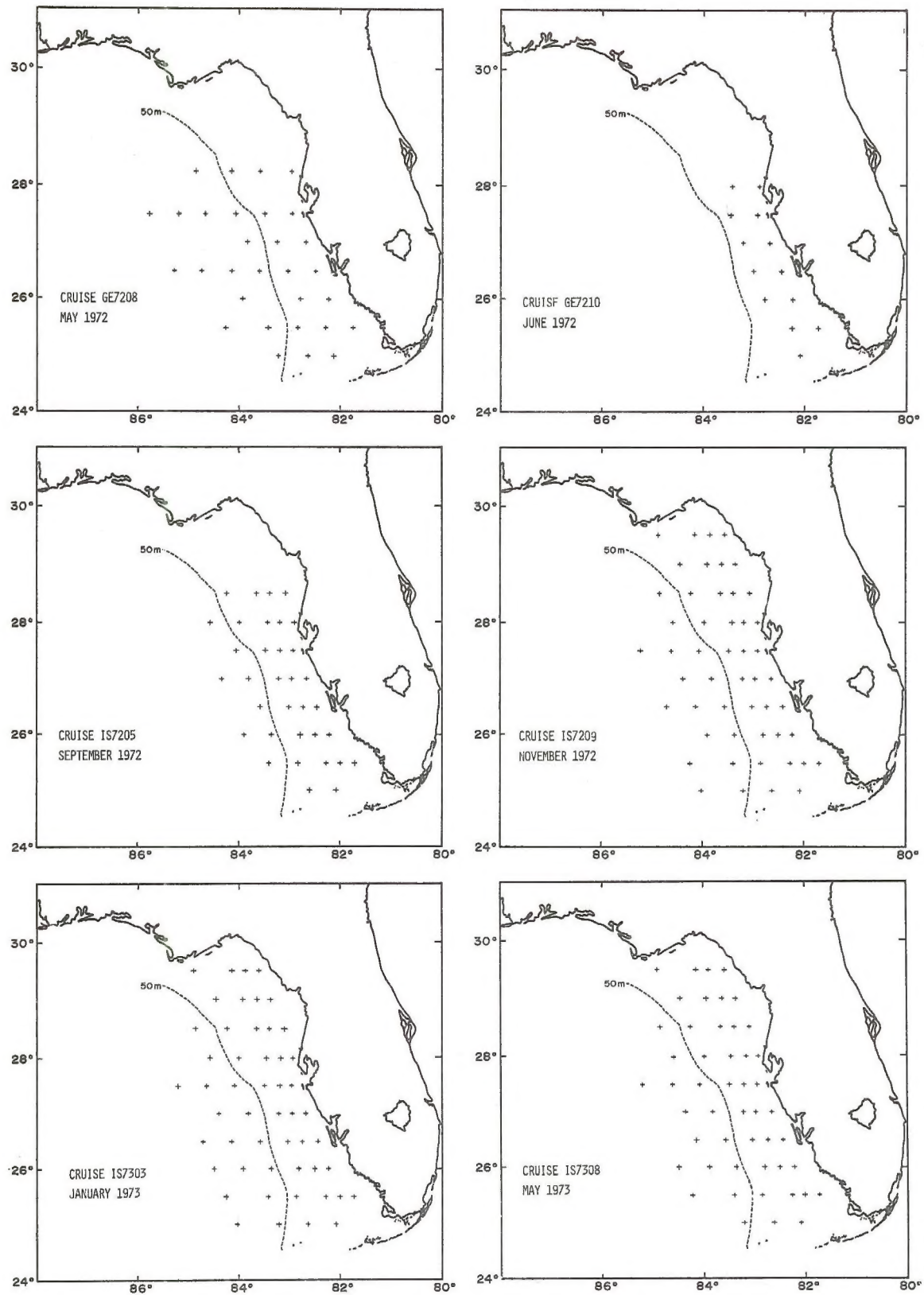


Fig. 2

Cont.

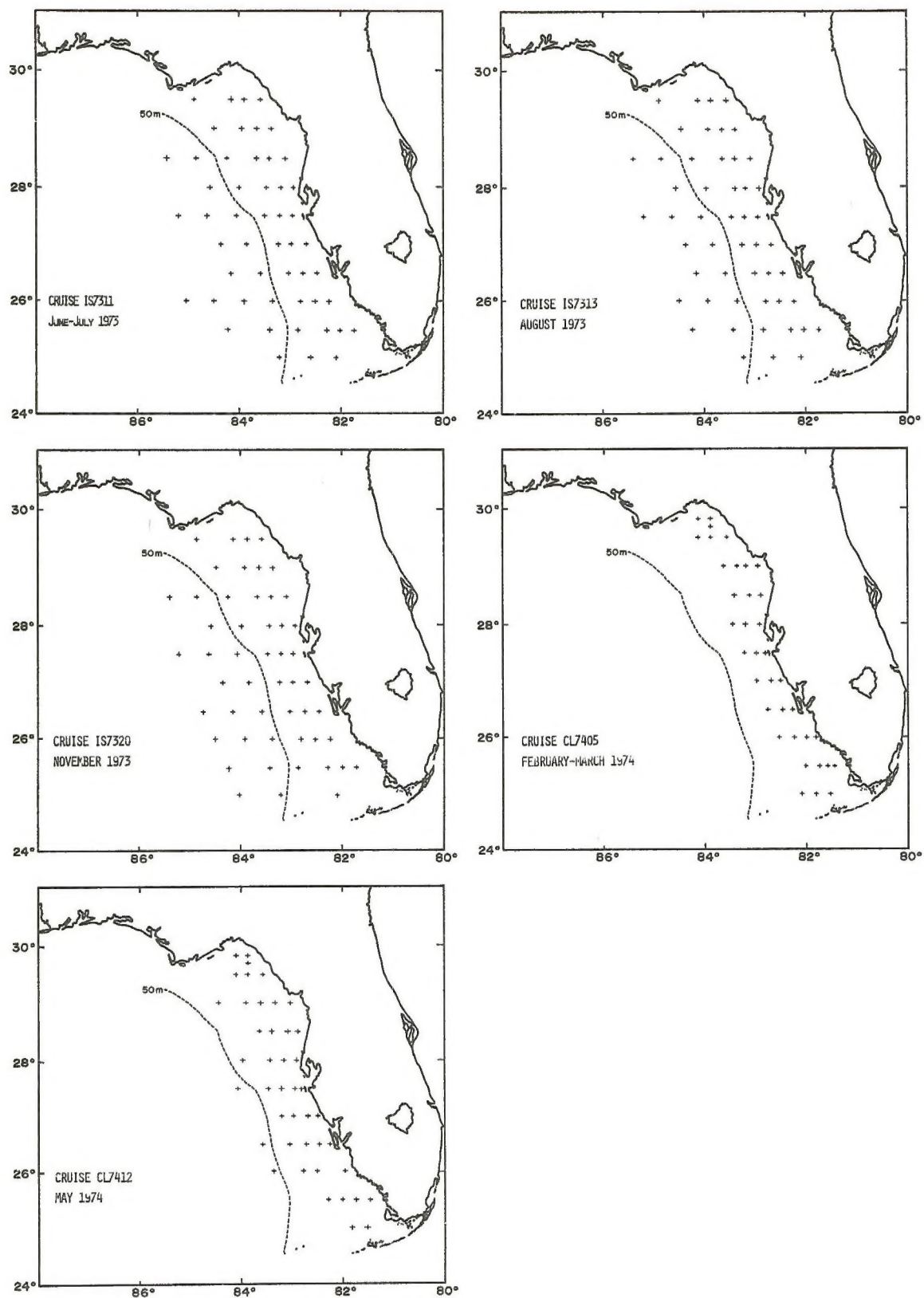


Fig. 2

Cont.

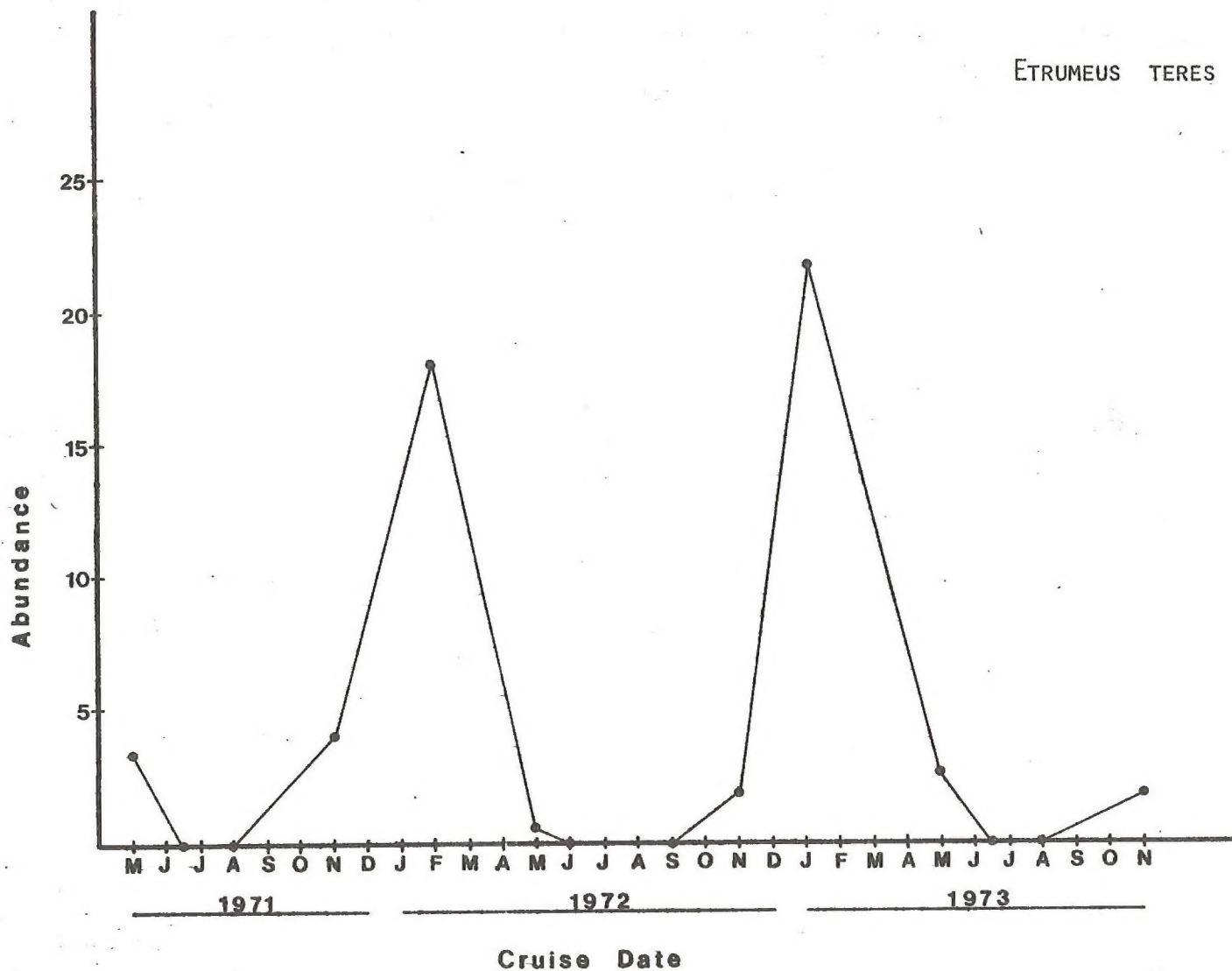


Fig. 3

Estimated mean abundances (number under 10 m² of sea surface) of Etrumeus teres larvae in the eastern Gulf of Mexico, 1971-1974.

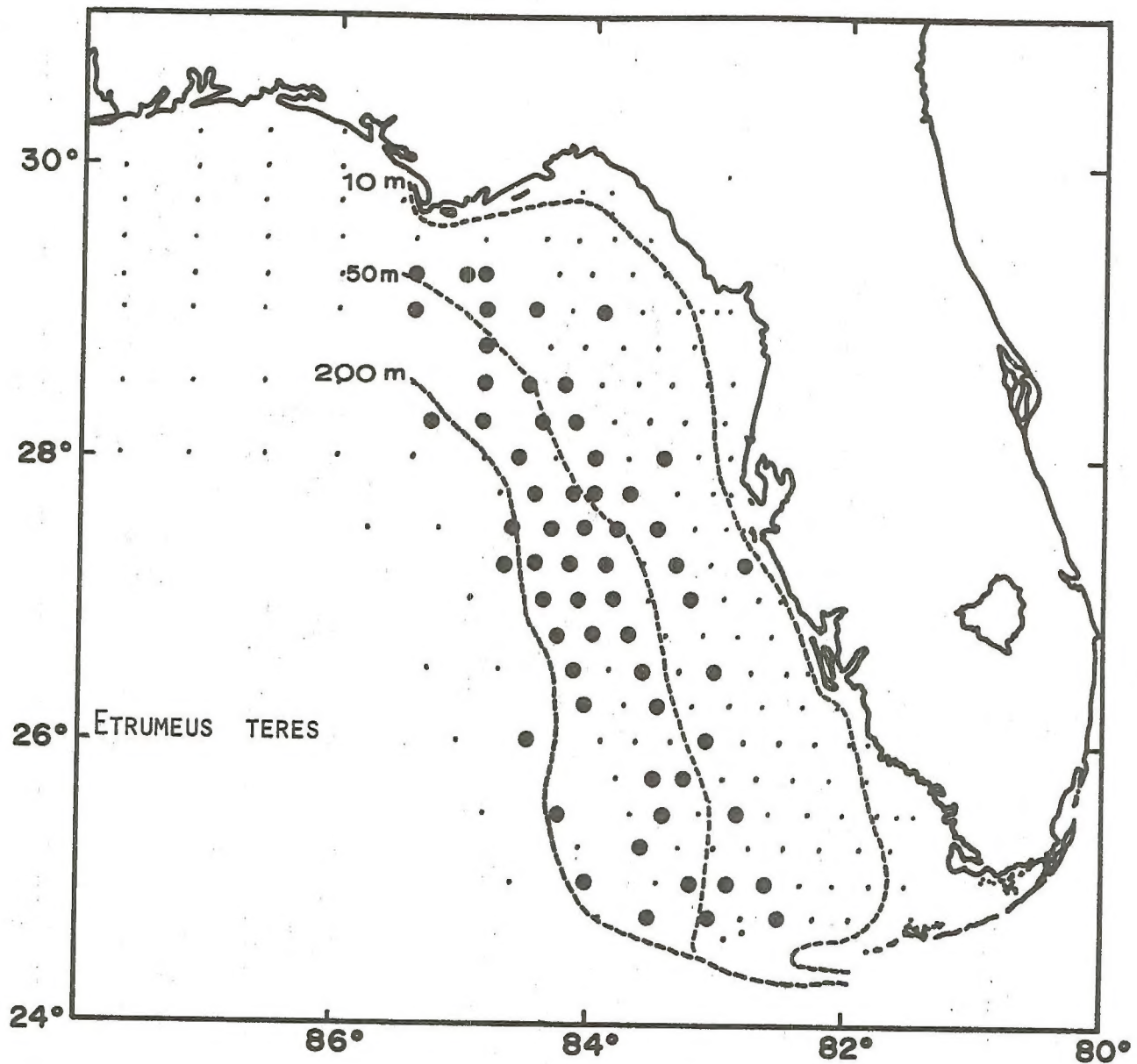


Fig. 4

Stations at which Etrumeus teres larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

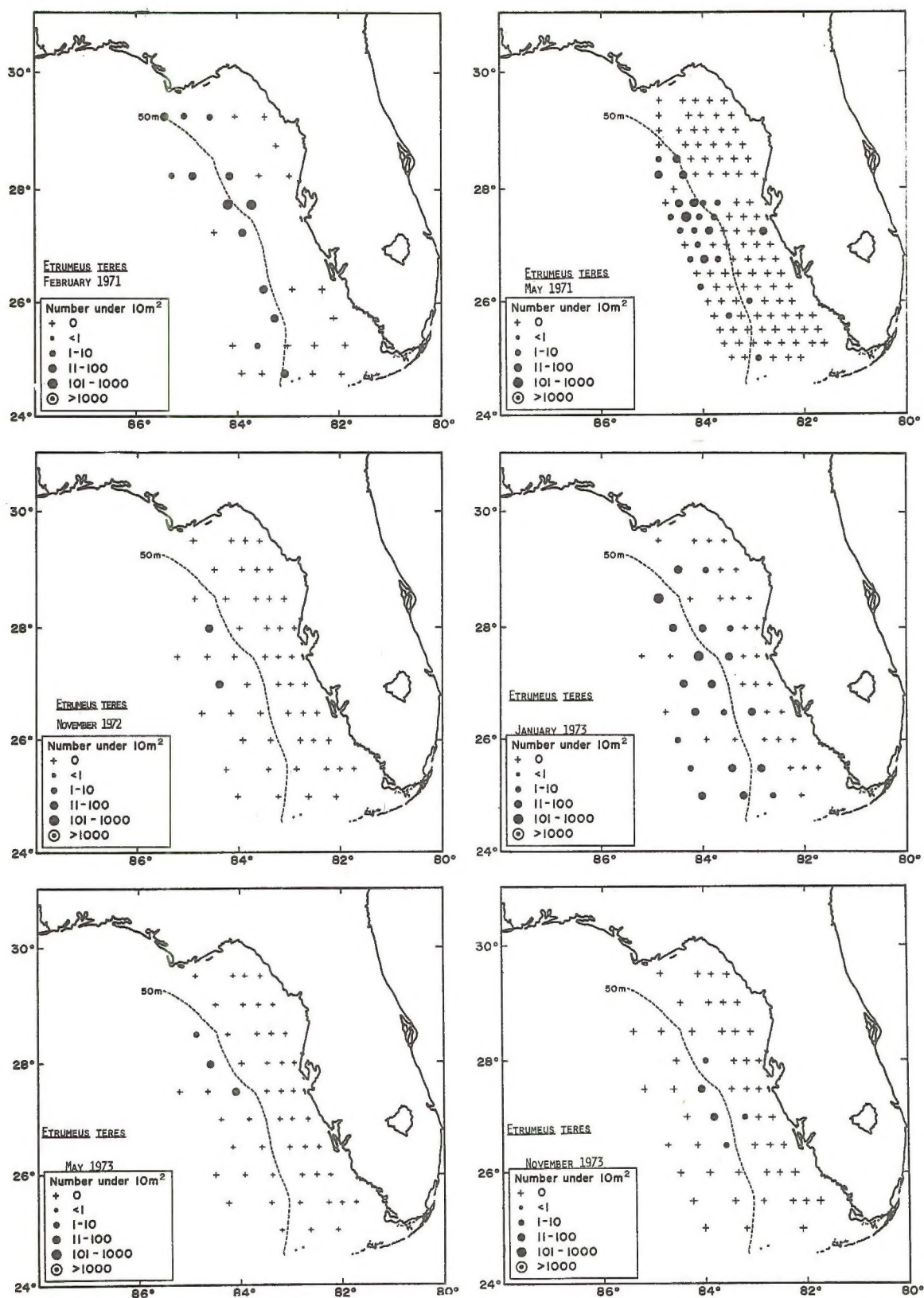


Fig. 5 Distribution and abundance of *Etrumeus teres* larvae in the eastern Gulf of Mexico, 1971-1974.

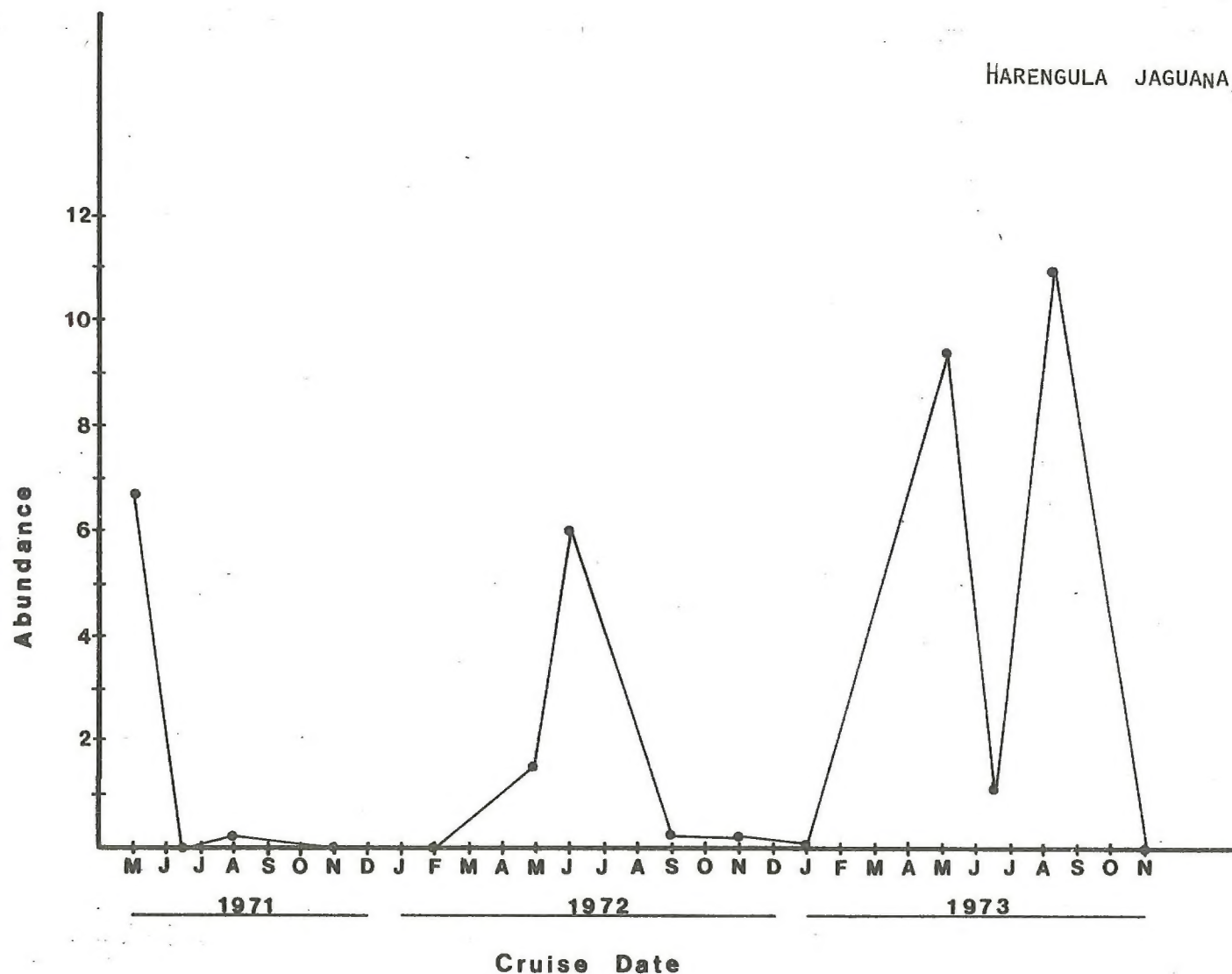


Fig. 6

Estimated mean abundances (number under 10 m² of sea surface) of Harengula jaguana larvae in the eastern Gulf of Mexico, 1971-1974.

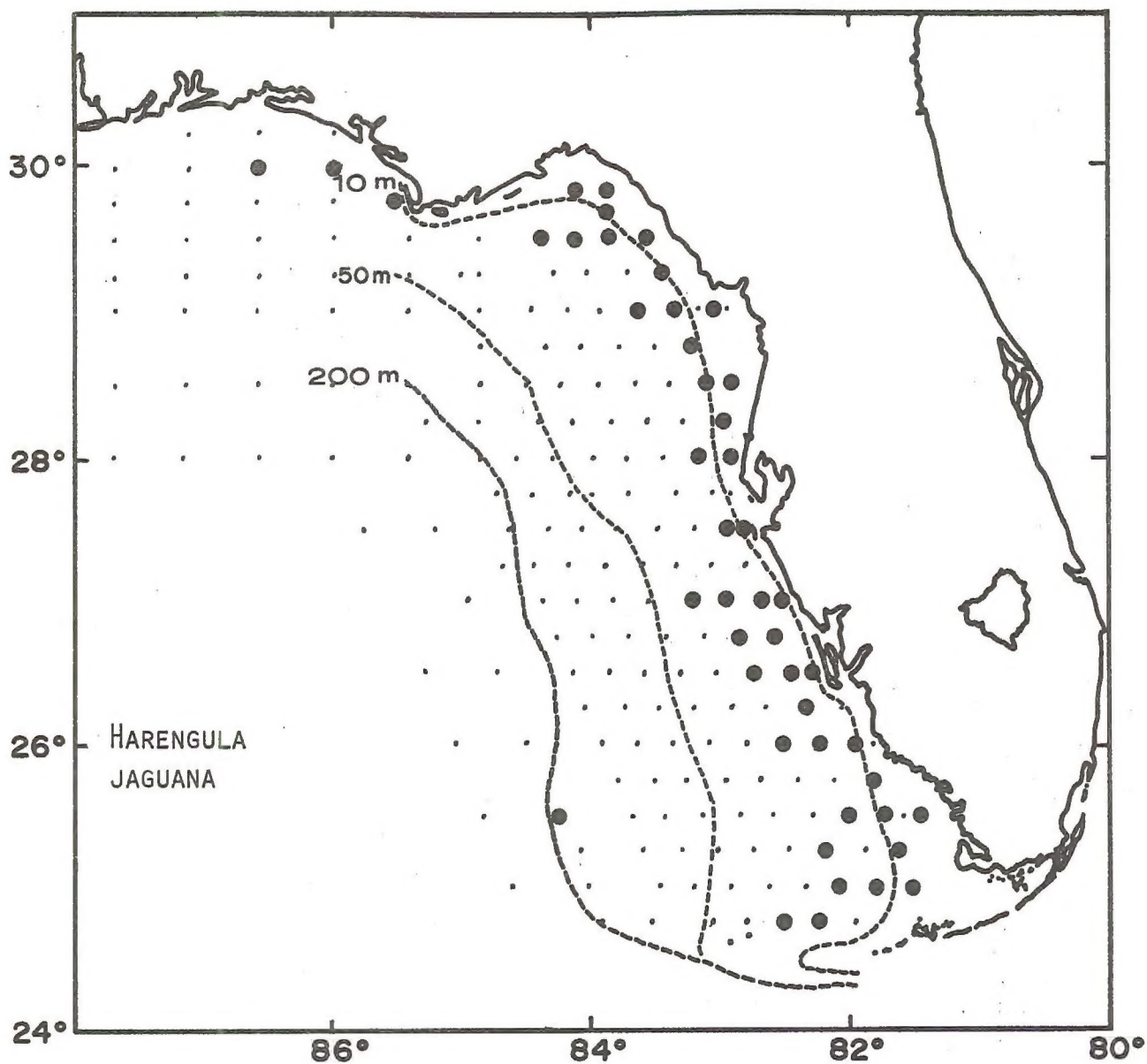


Fig. 7 Stations at which *Harengula jaguana* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

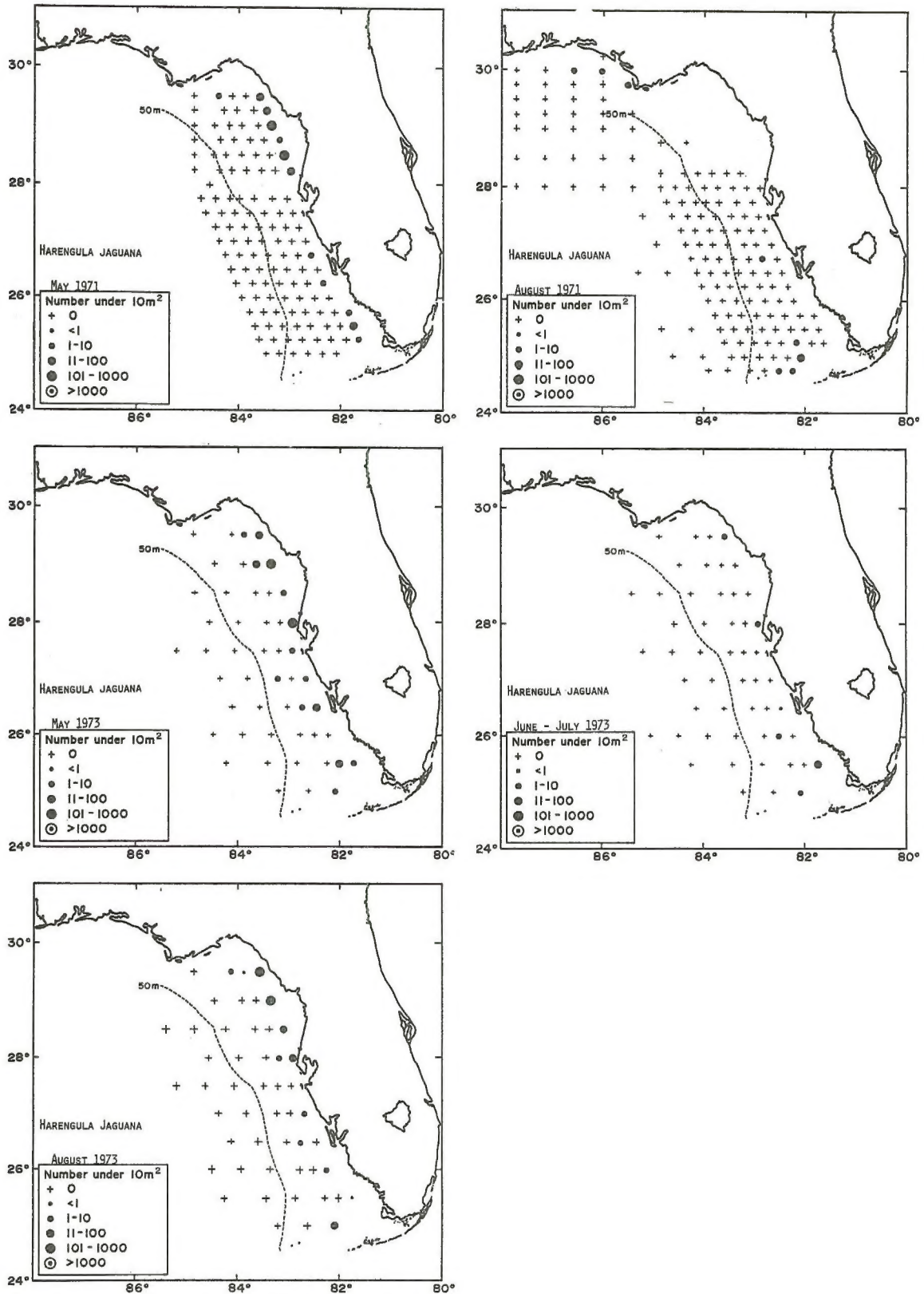


Fig. 8 Distribution and abundance of *Harengula jaguana* larvae in the eastern Gulf of Mexico, 1971-1974.

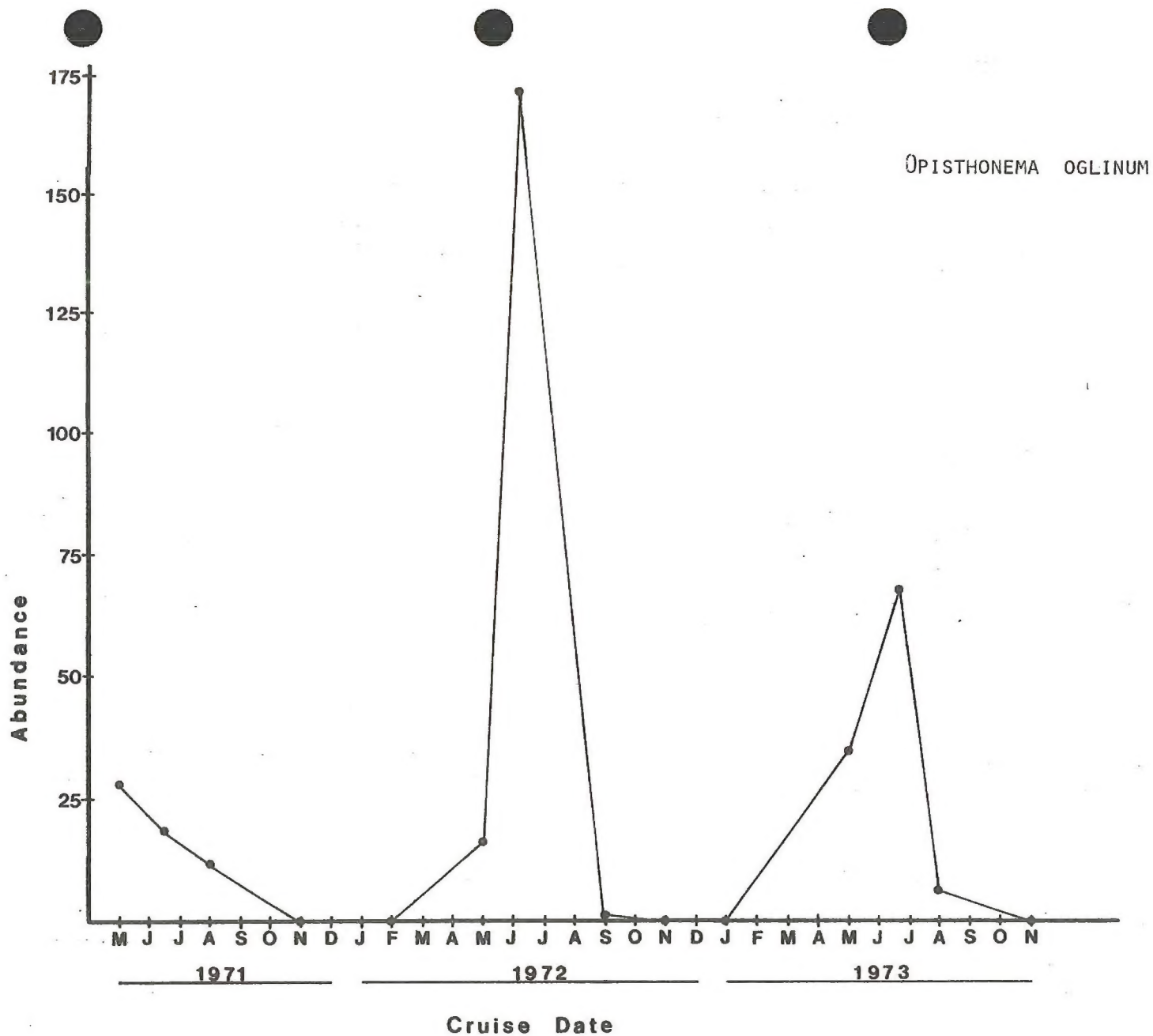


Fig. 9

Estimated mean abundances (number under 10 m² of sea surface) of Opisthonema oglinum larvae in the eastern Gulf of Mexico, 1971-1974.

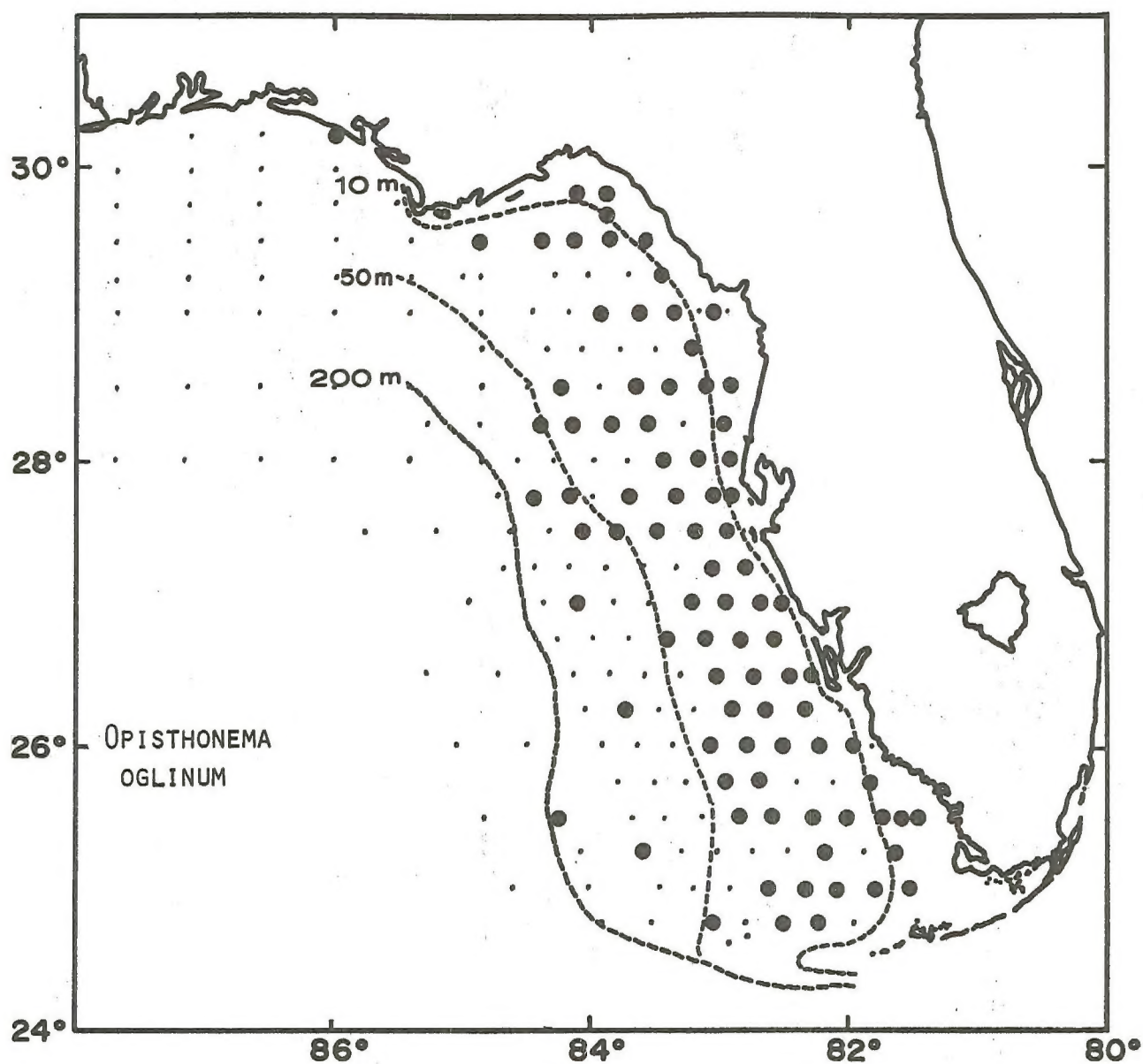


Fig. 10

Stations at which *Opisthonema oglinum* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

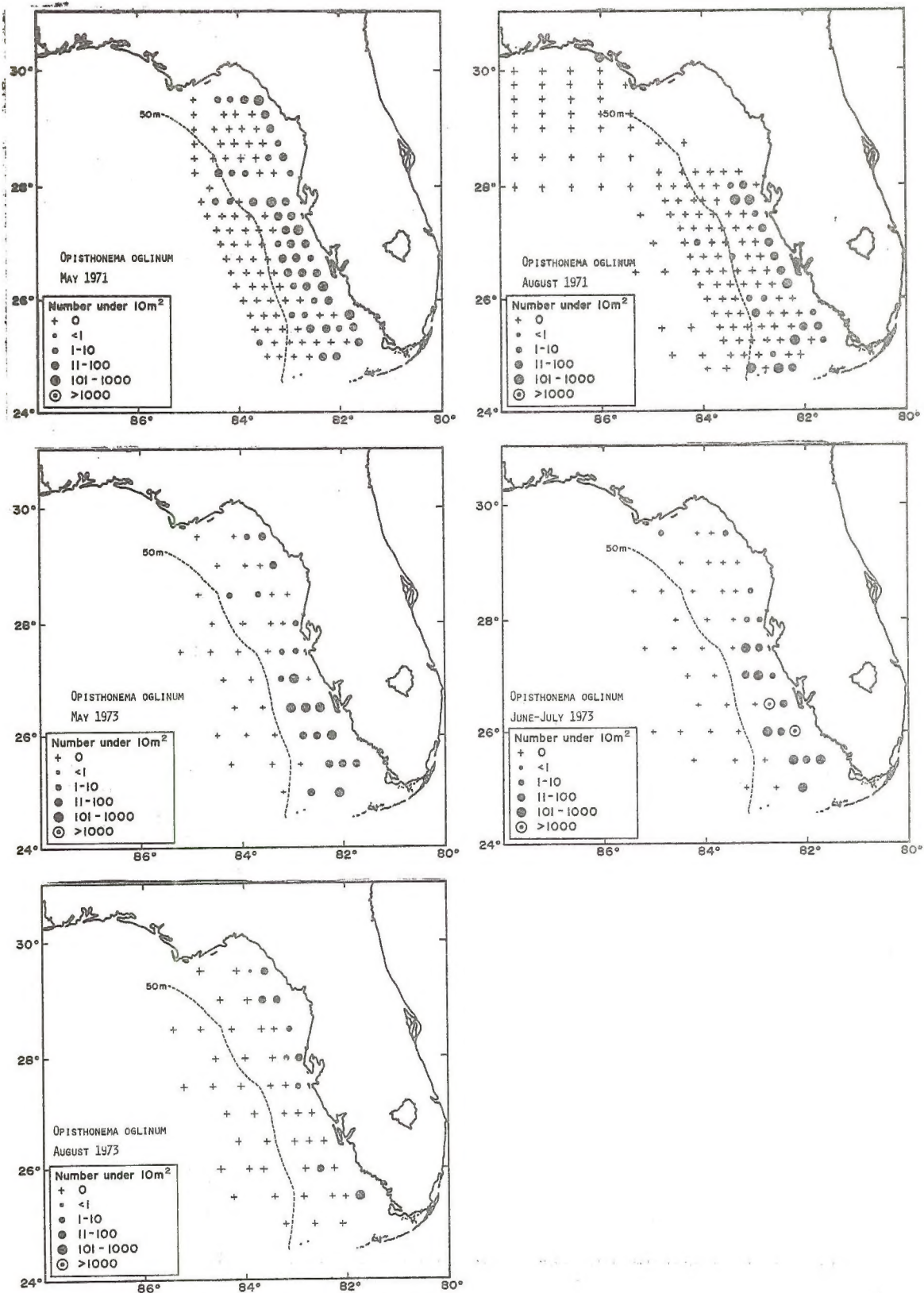


Fig. 11 Distribution and abundance of *Opisthonema oglinum* larvae in the eastern Gulf of Mexico, 1971-1974.

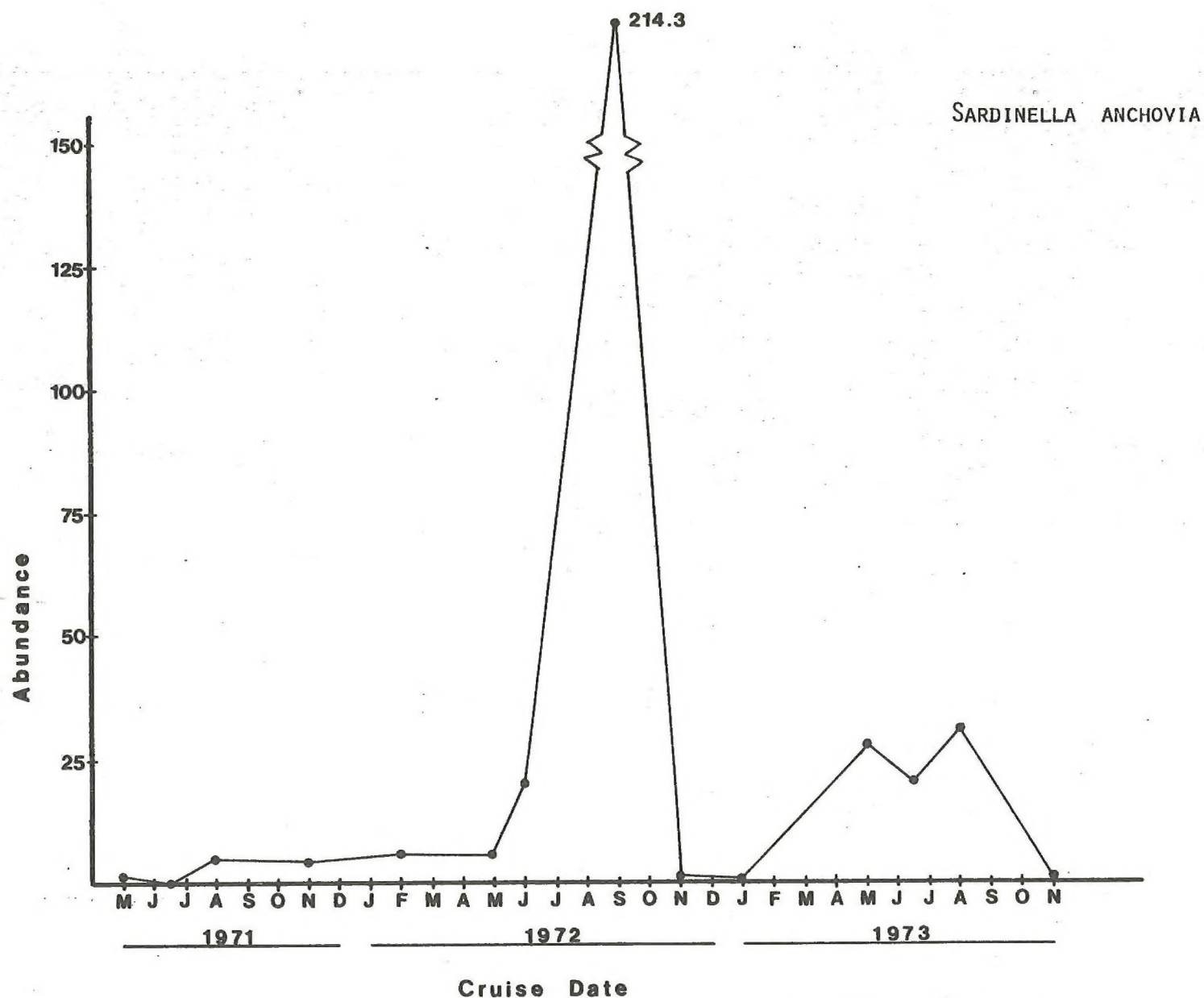


Fig. 12

Estimated mean abundances (number under 10 m² of sea surface) of *Sardinella anchovia* larvae in the eastern Gulf of Mexico, 1971-1974.

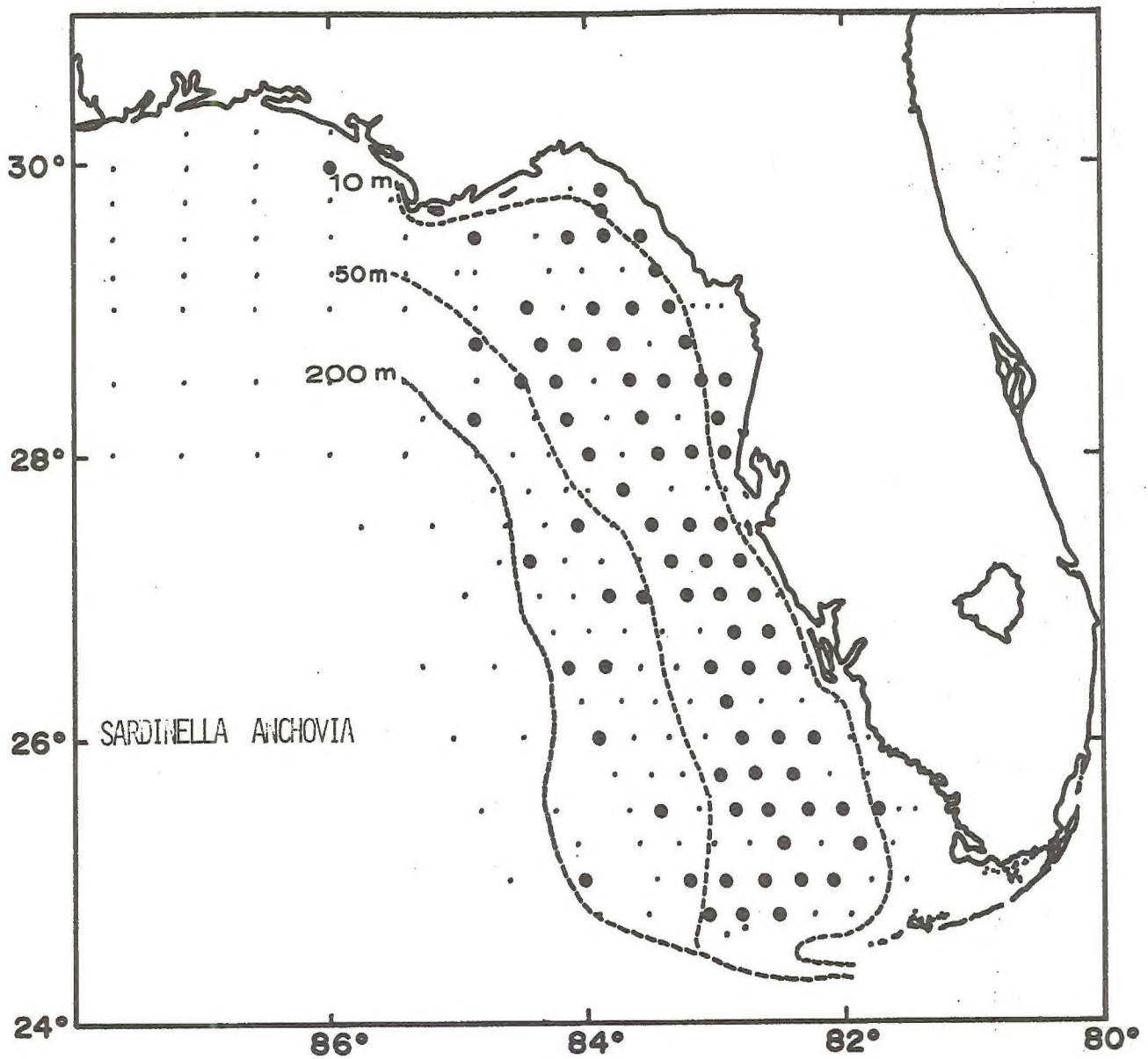


Fig. 13 Stations at which *Sardinella anchovia* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

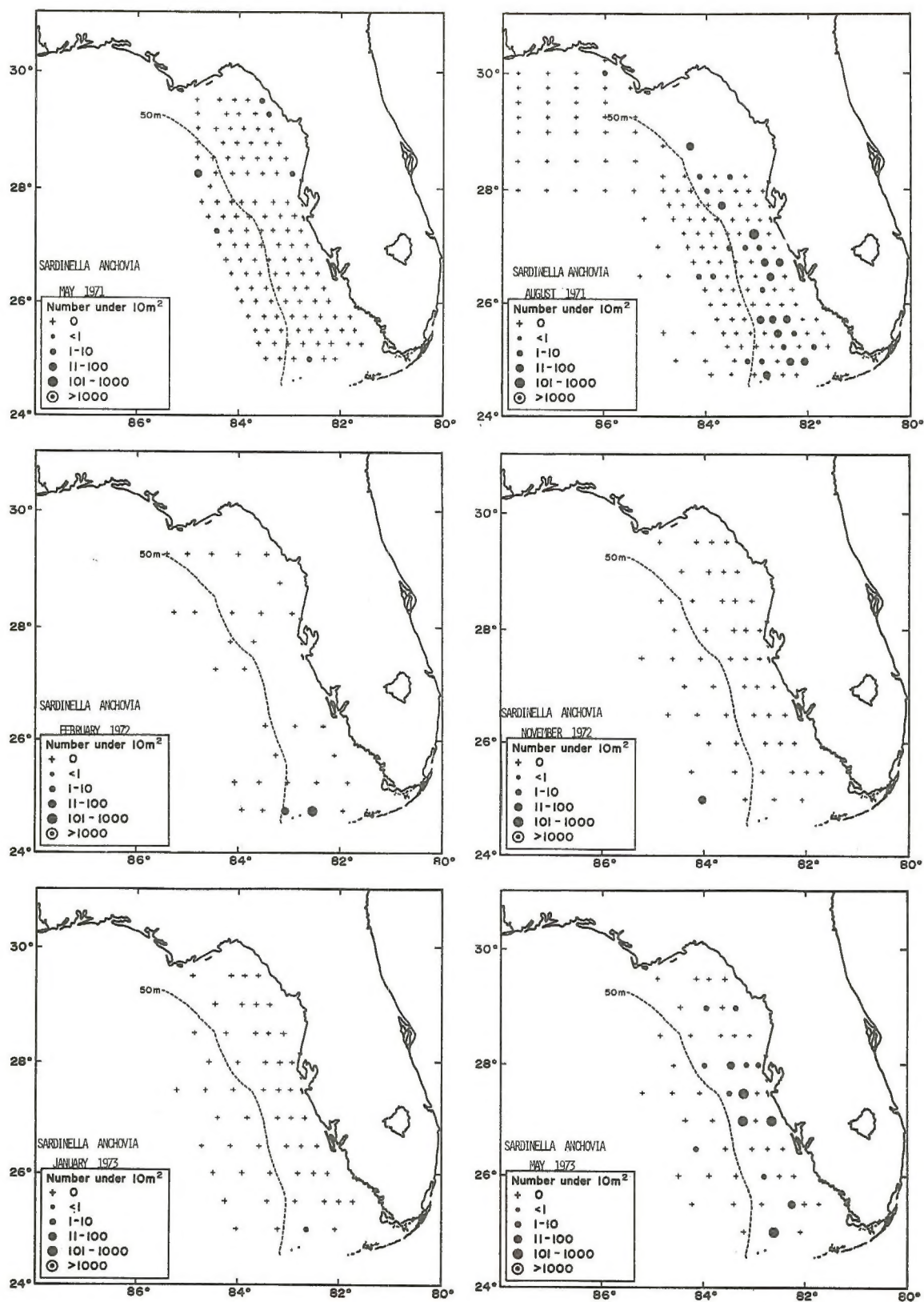


Fig. 14 Distribution and abundance of *Sardinella anchovia* larvae in the eastern Gulf of Mexico, 1971-1974.

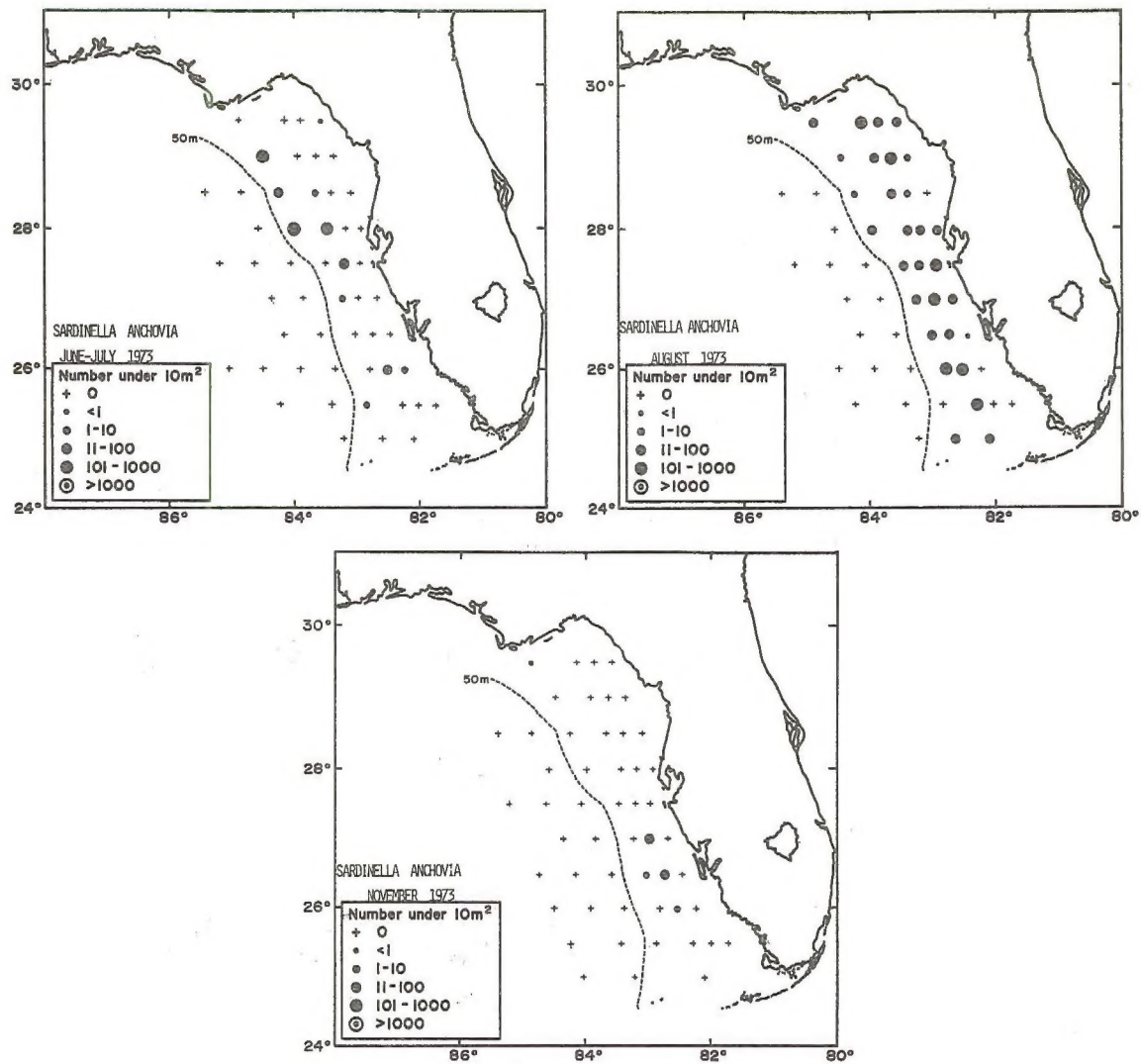


Fig. 14

Cont.

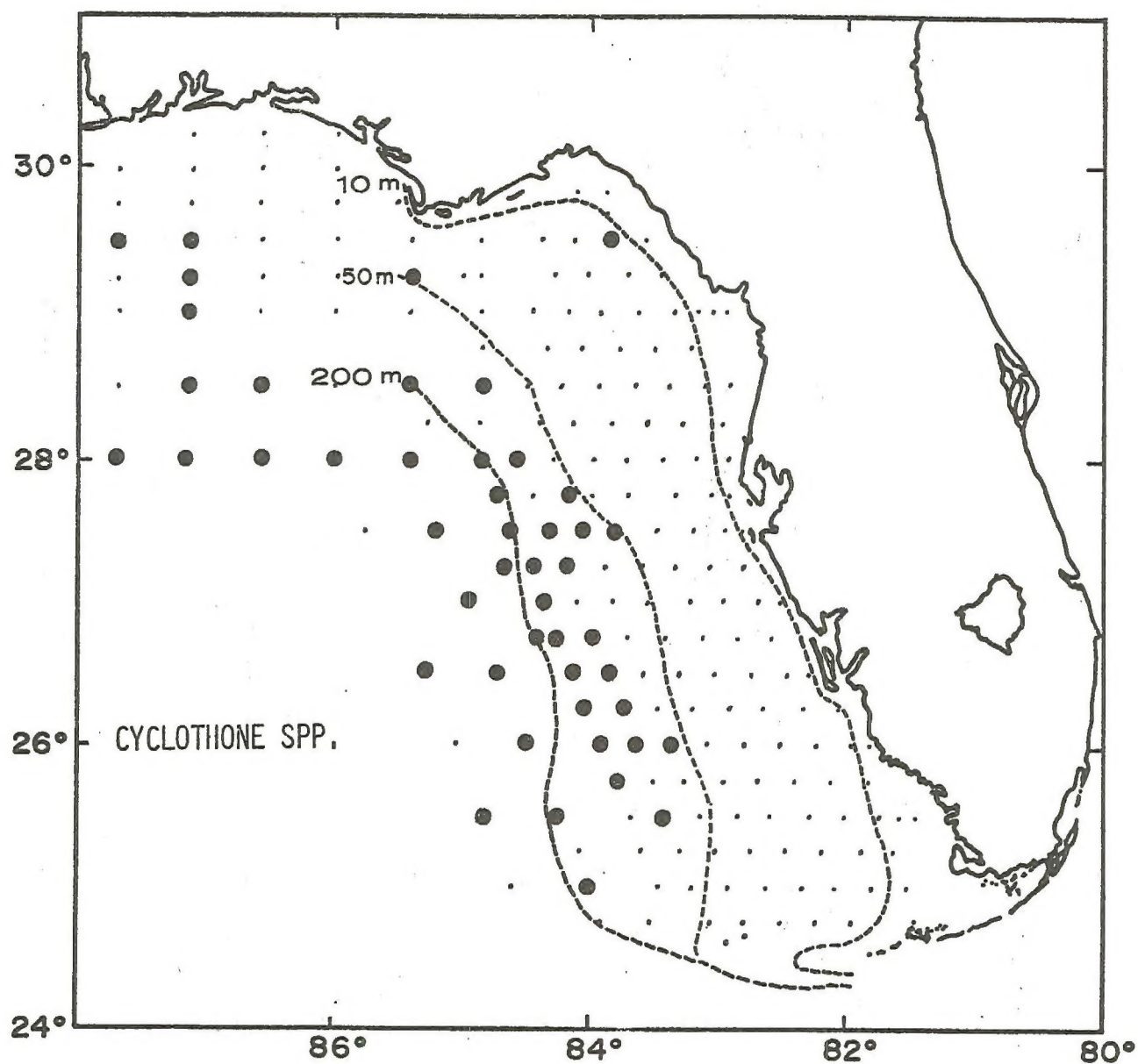


Fig. 15

Stations at which *Cyclothone* spp. larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

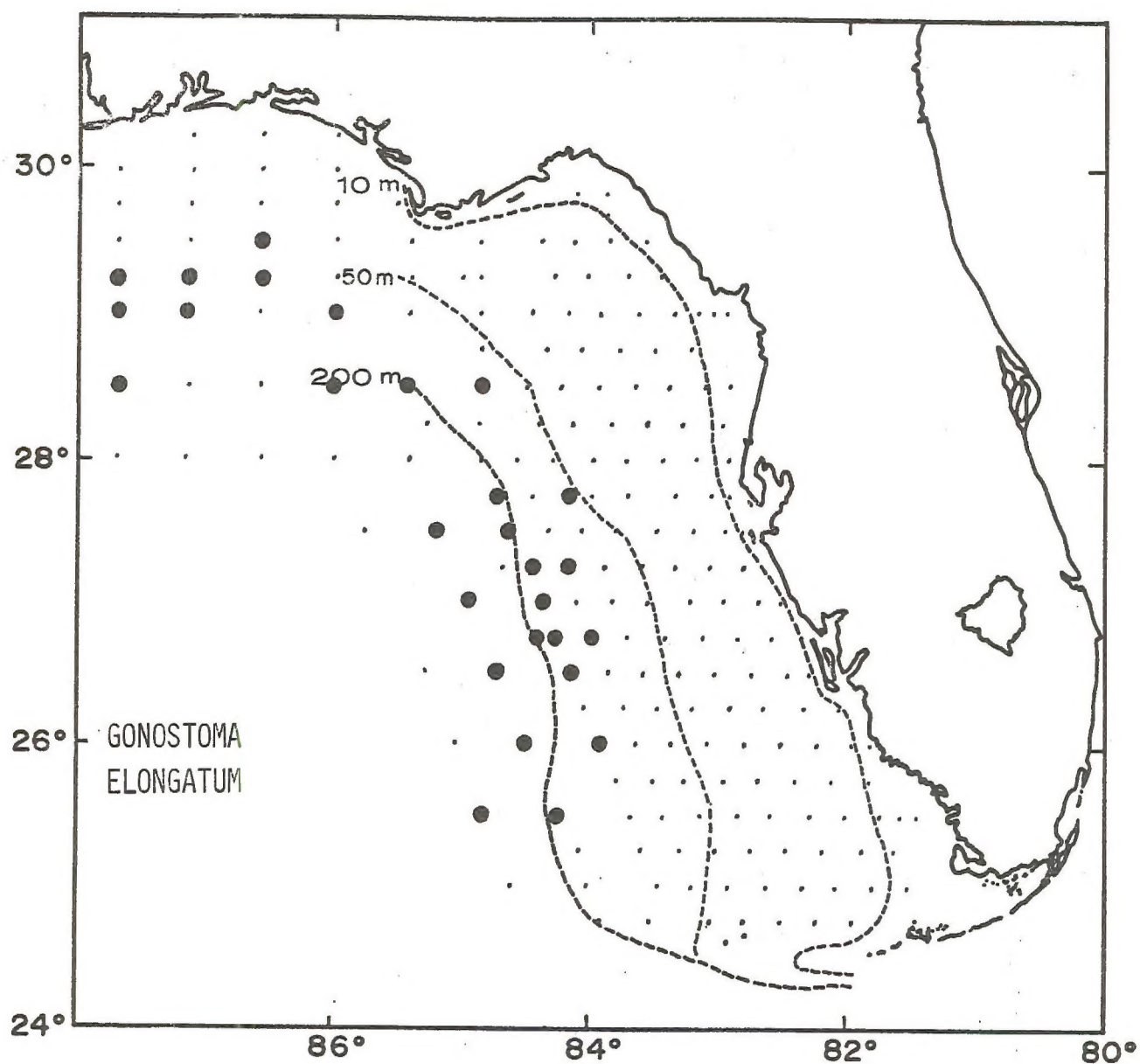


Fig. 16

Stations at which *Gonostoma elongatum* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

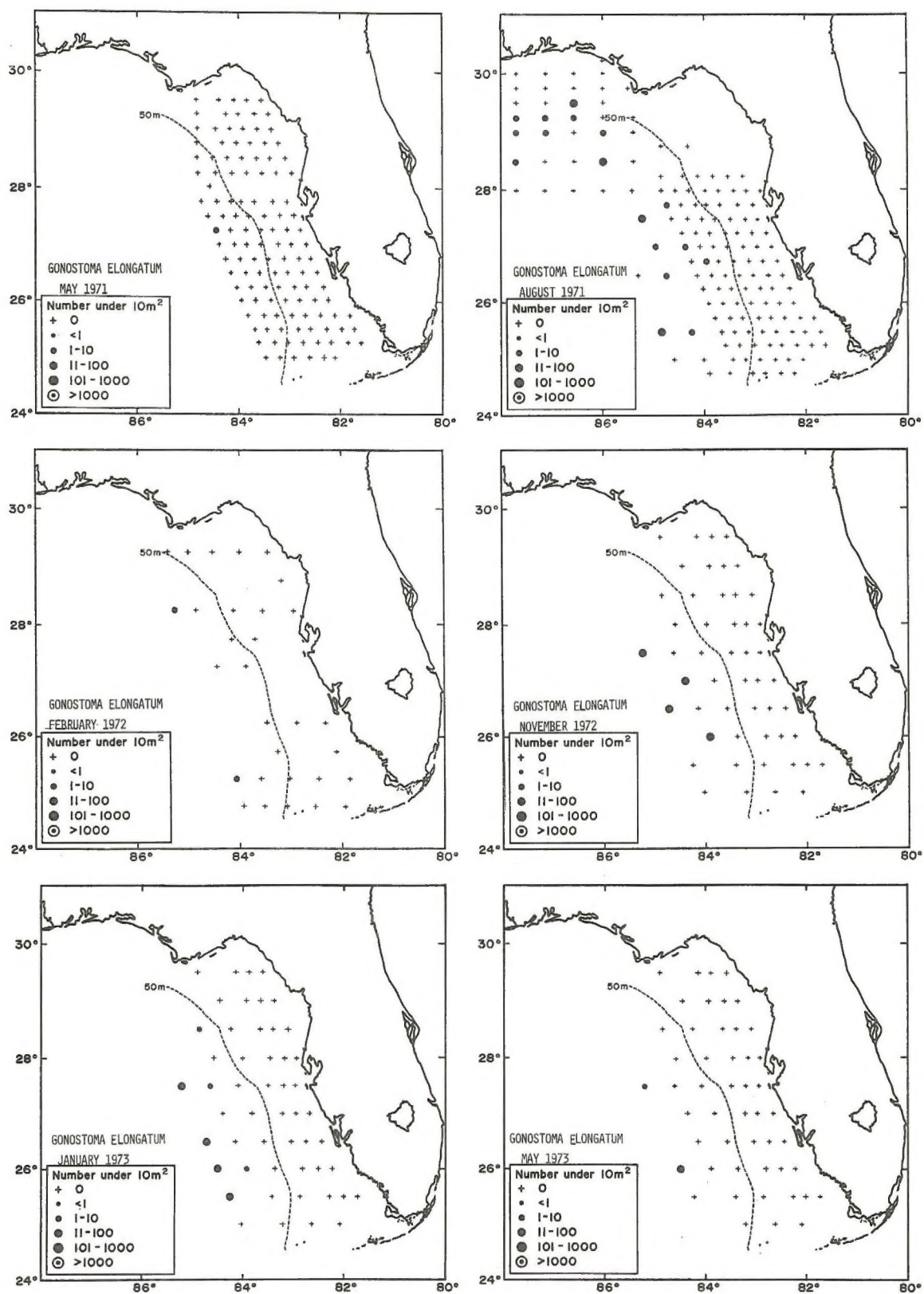


Fig. 17

Distribution and abundance of *Gonostoma elongatum* larvae in the eastern Gulf of Mexico, 1971-1974.

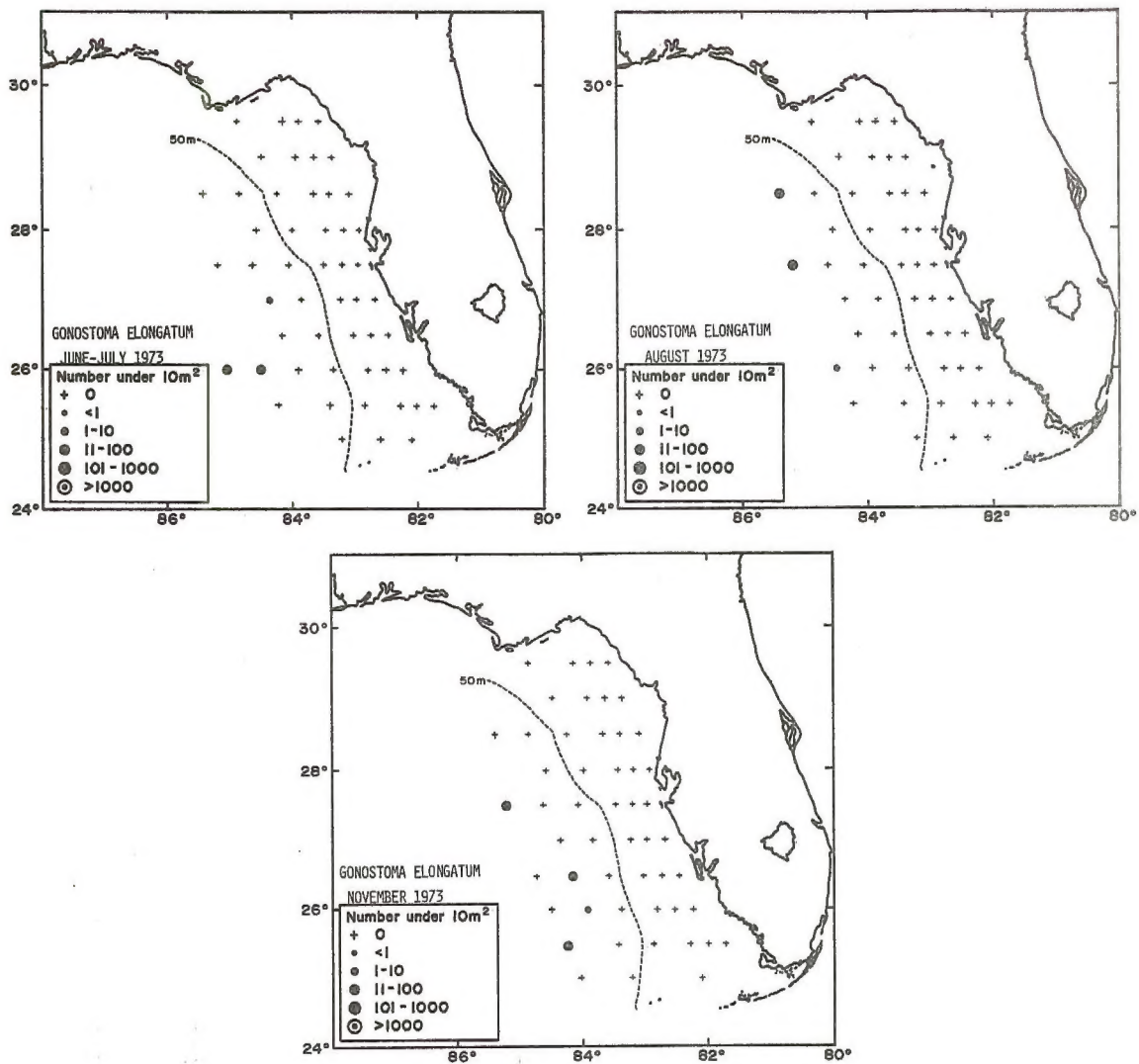


Fig. 17

Cont.

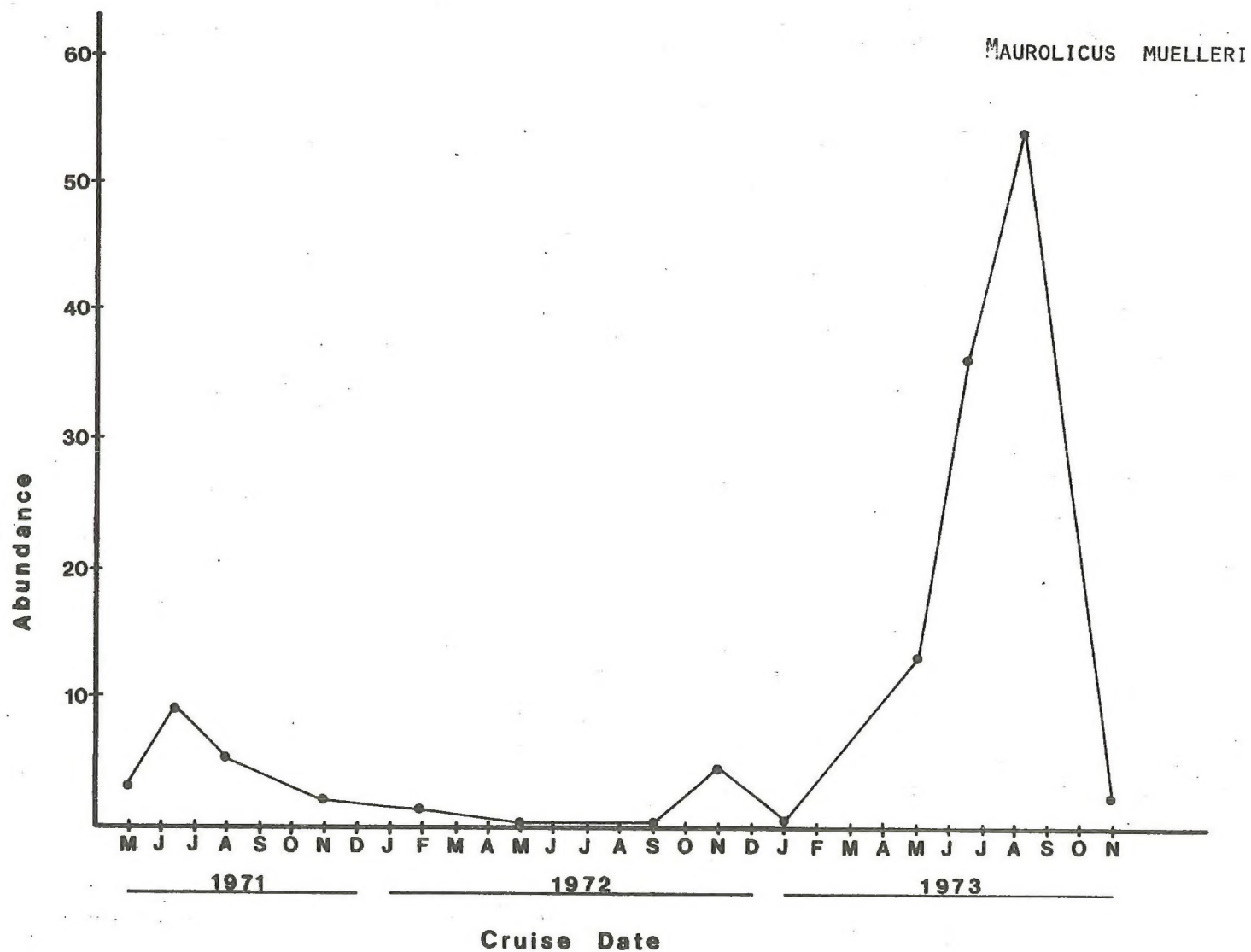


Fig. 18

Estimated mean abundances (number under 10m^2 of sea surface) of Maurolicus muelleri larvae in the eastern Gulf of Mexico, 1971-1974.

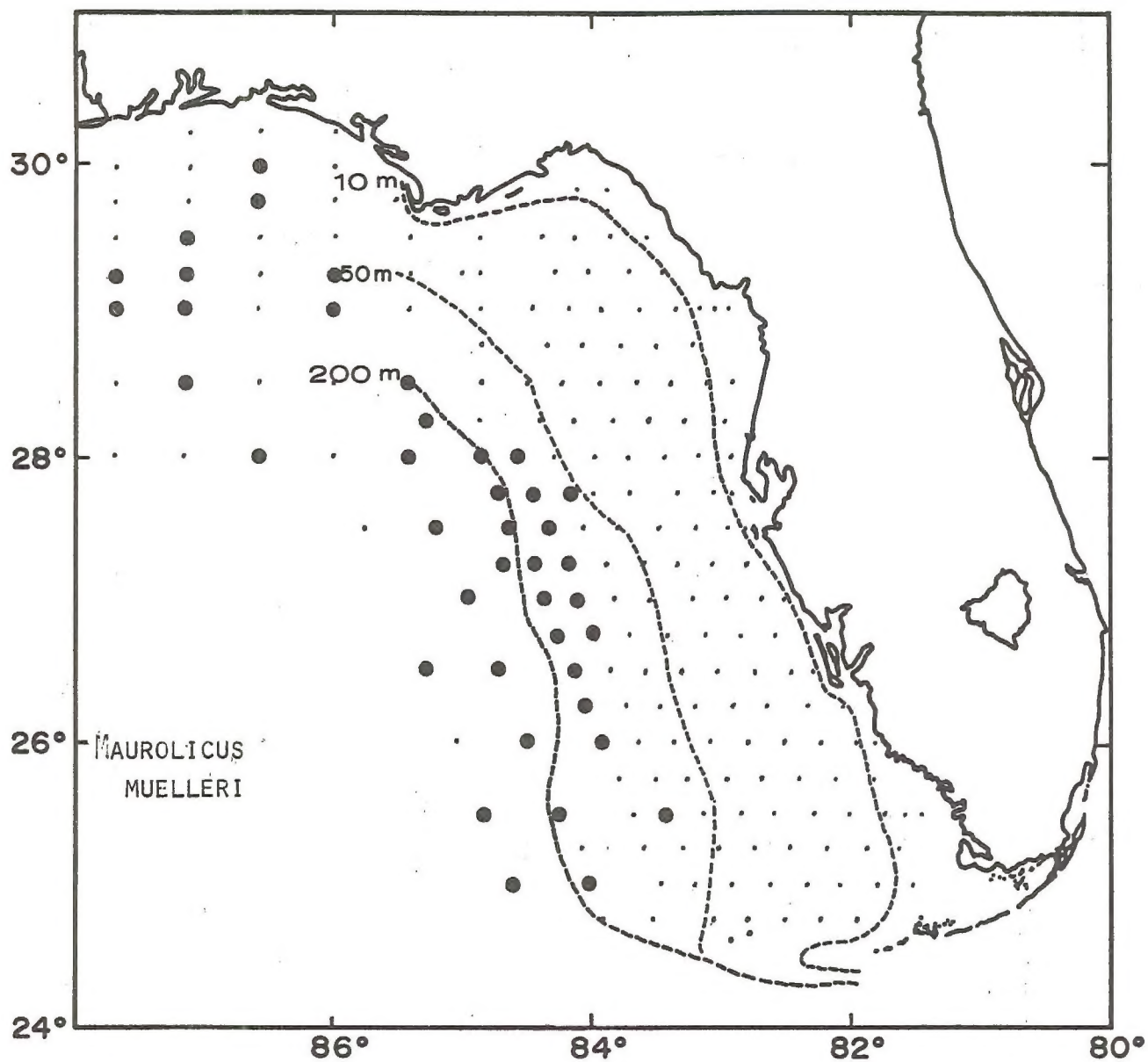


Fig. 19

Stations at which *Maurolicus muelleri* larvae occurred at least once during 17 cruises in the eastern Gulf of Mexico, 1971-1974.

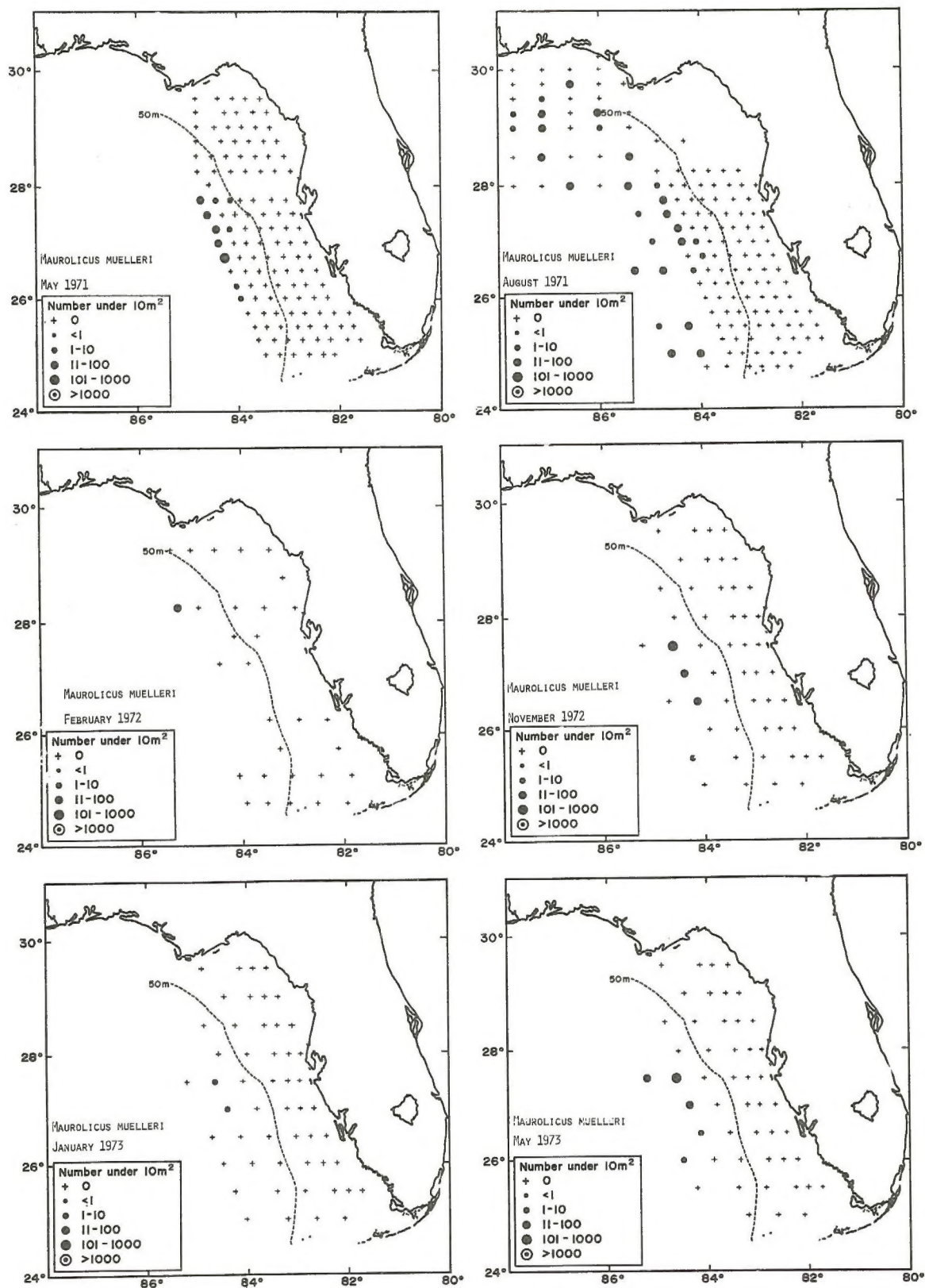


Fig. 20

Distribution and abundance of *Maurolicus muelleri* larvae in the eastern Gulf of Mexico, 1971-1974.

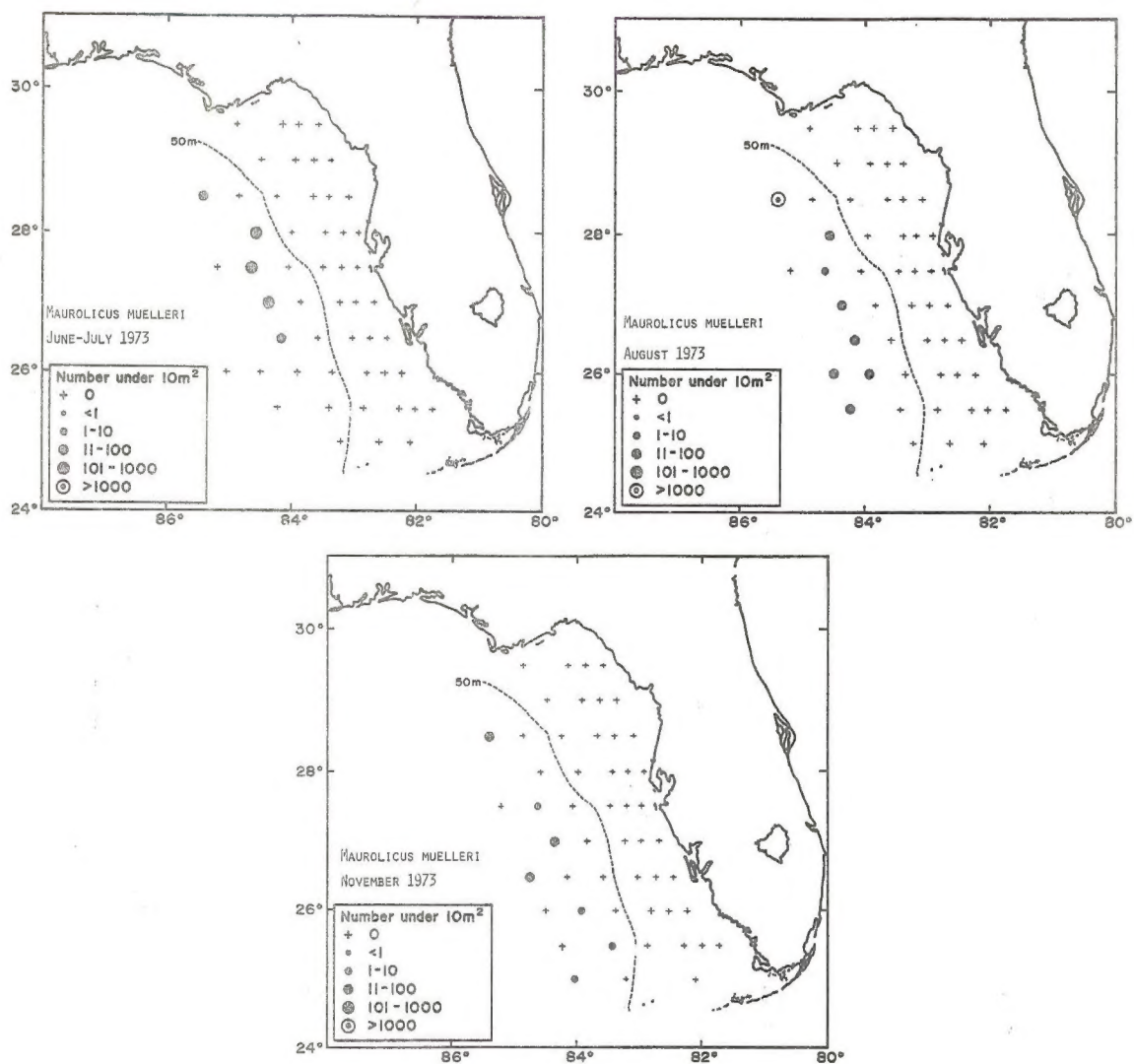


Fig. 20

Cont.

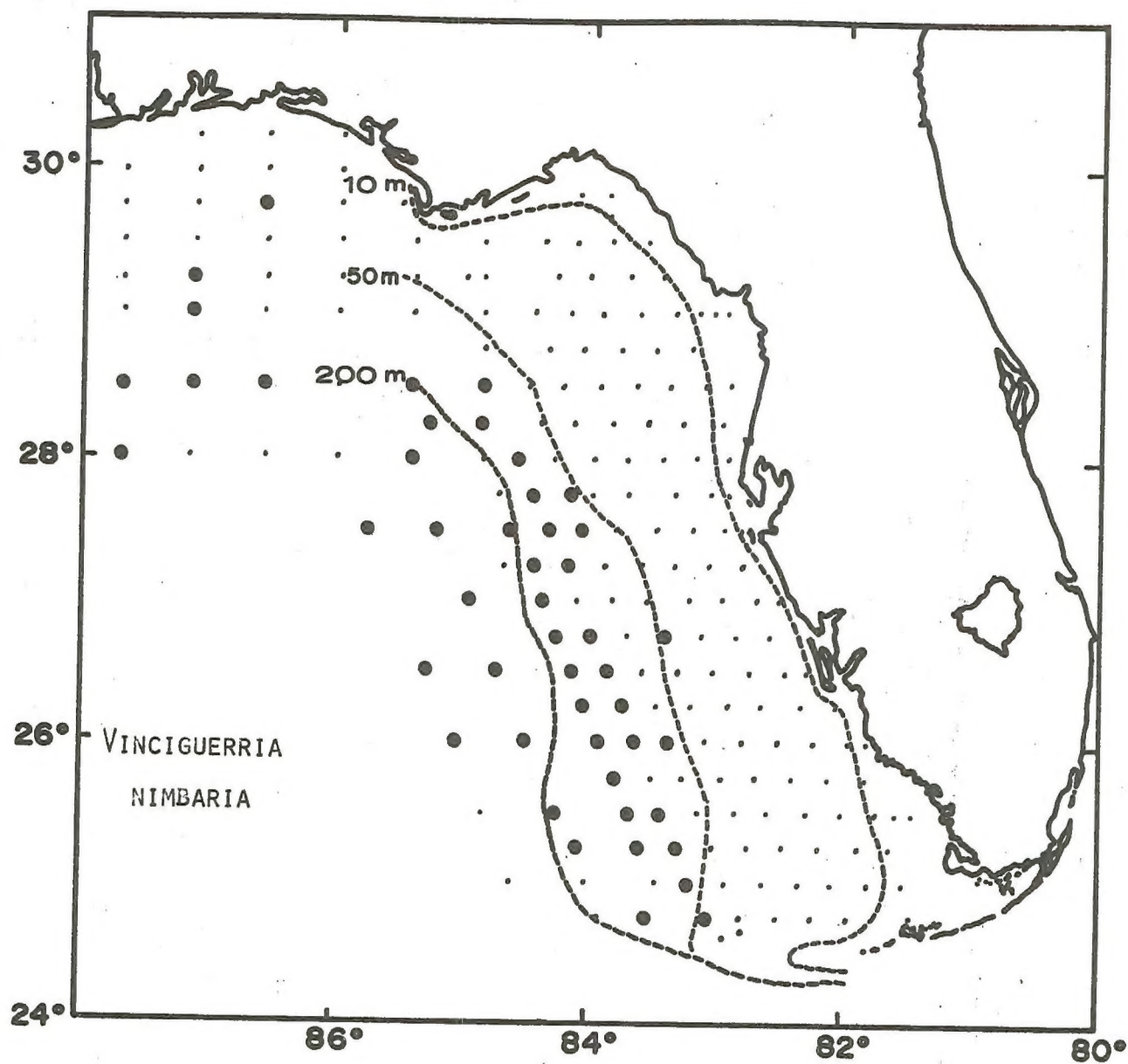


Fig. 21 Stations at which *Vinciguerria nimbaria* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

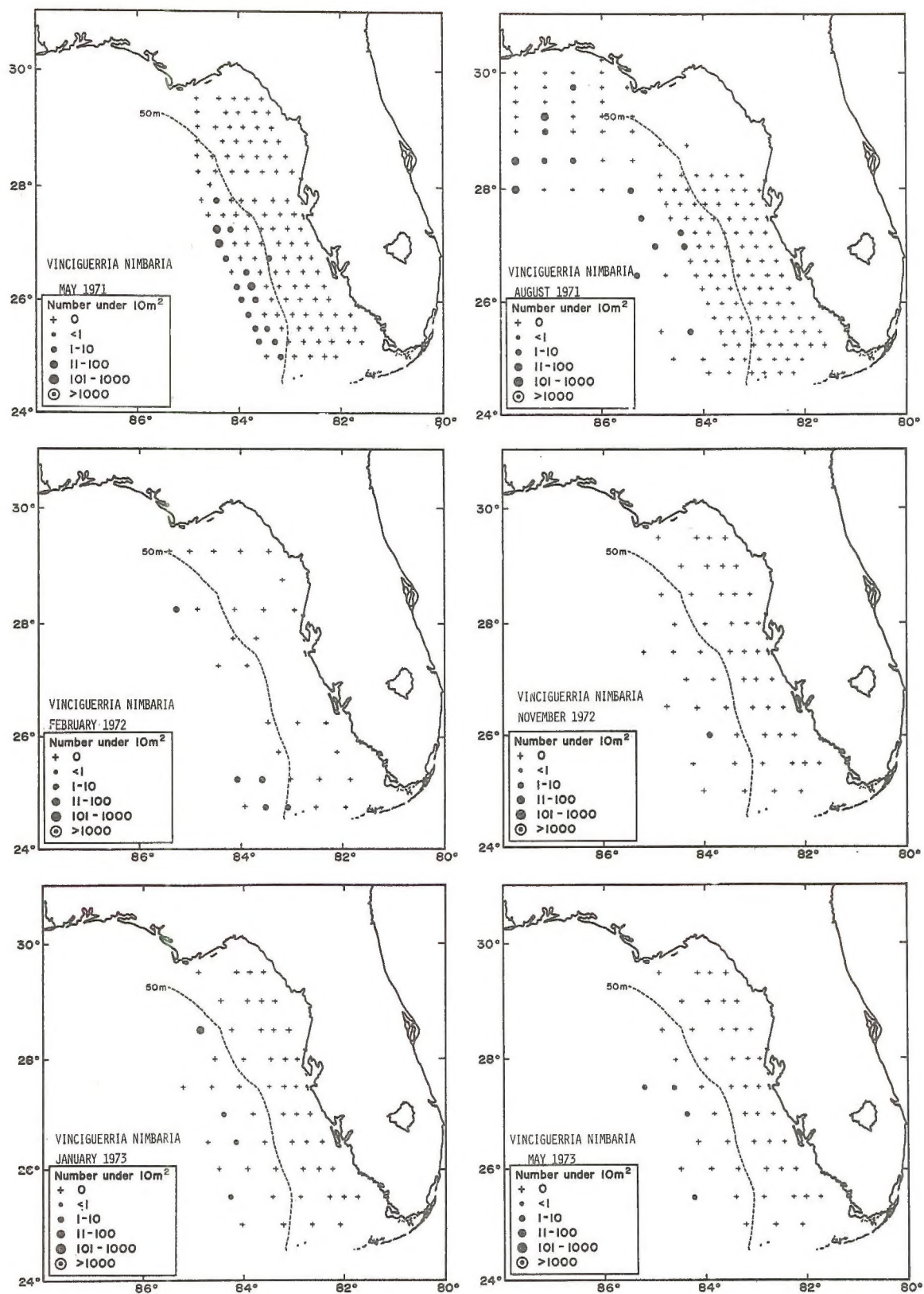


Fig. 22

Distribution and abundance of Vinciguerria nimbaria larvae in the eastern Gulf of Mexico, 1971-1974.

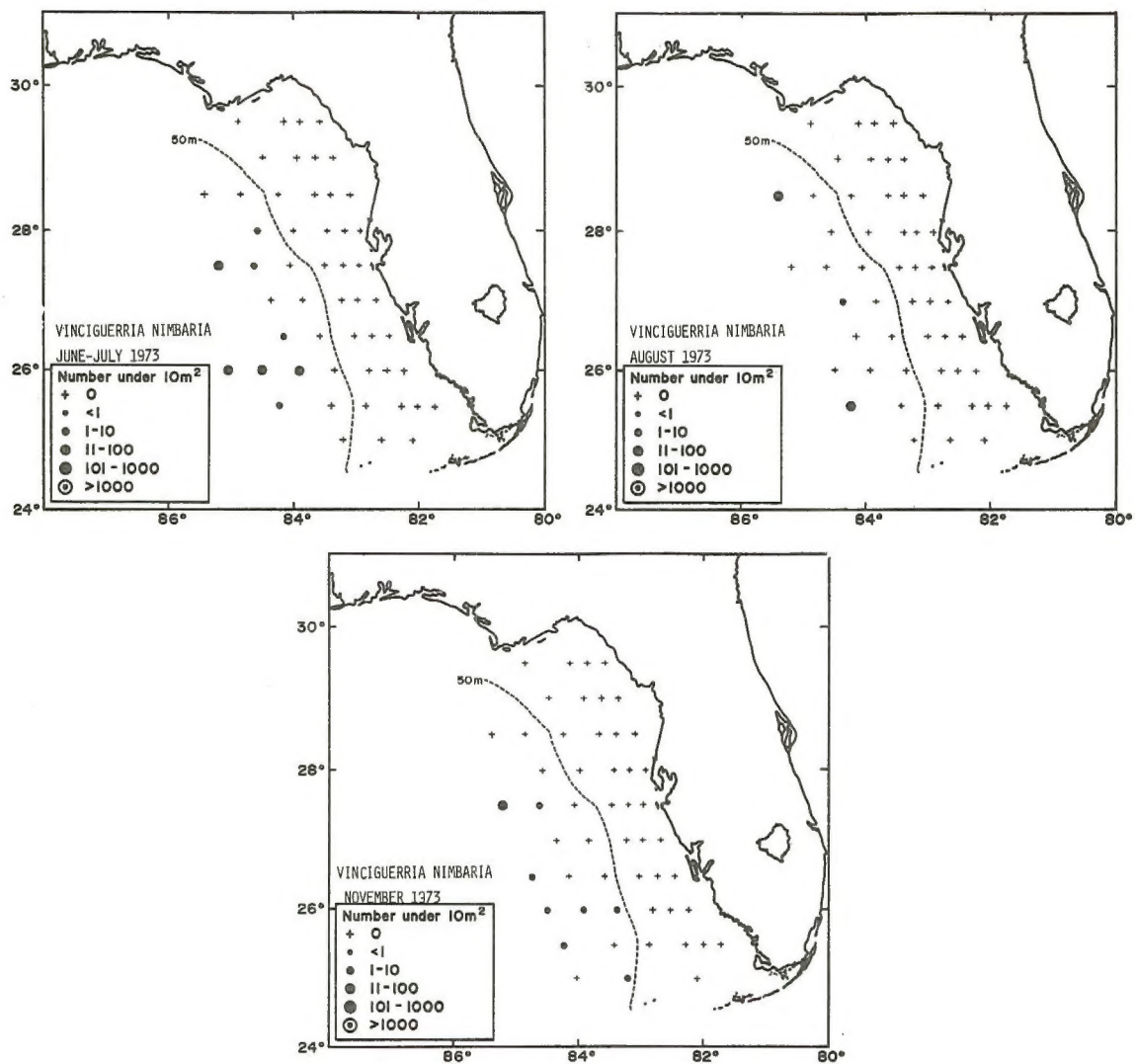


Fig. 22

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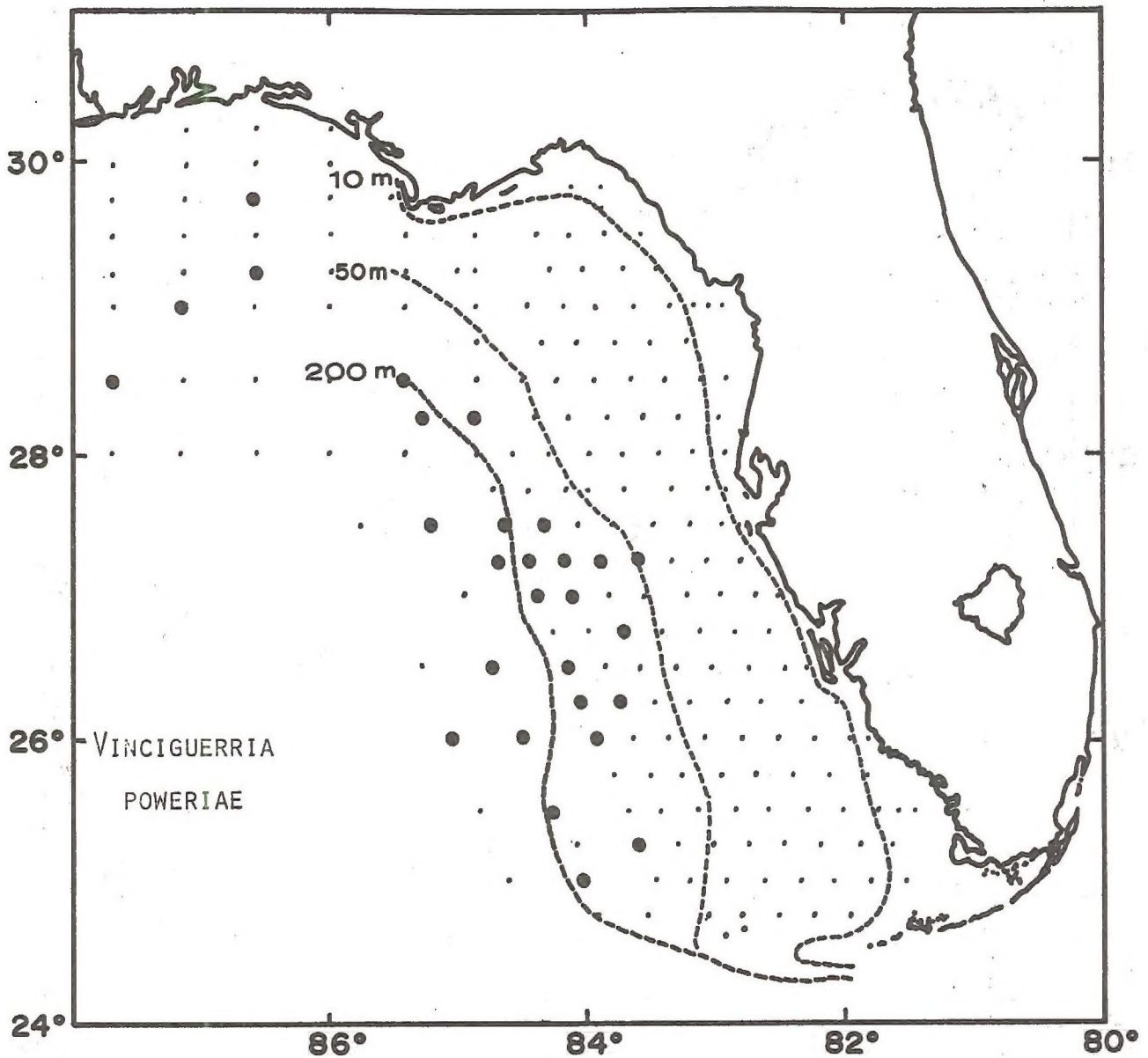


Fig. 23 Stations at which Vinciguerria poweriae larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

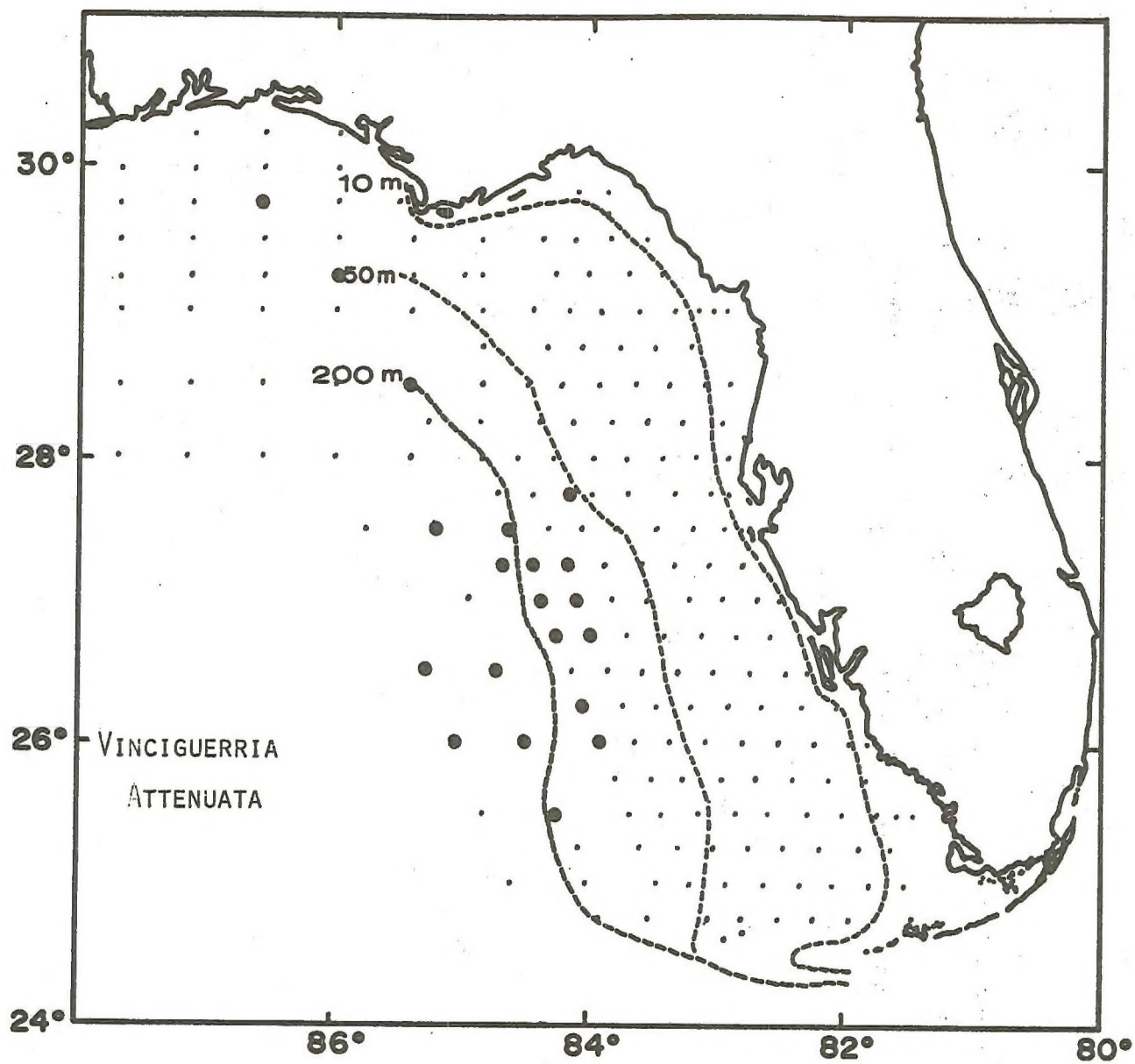


Fig. 24

Stations at which *Vinciguerria attenuata* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

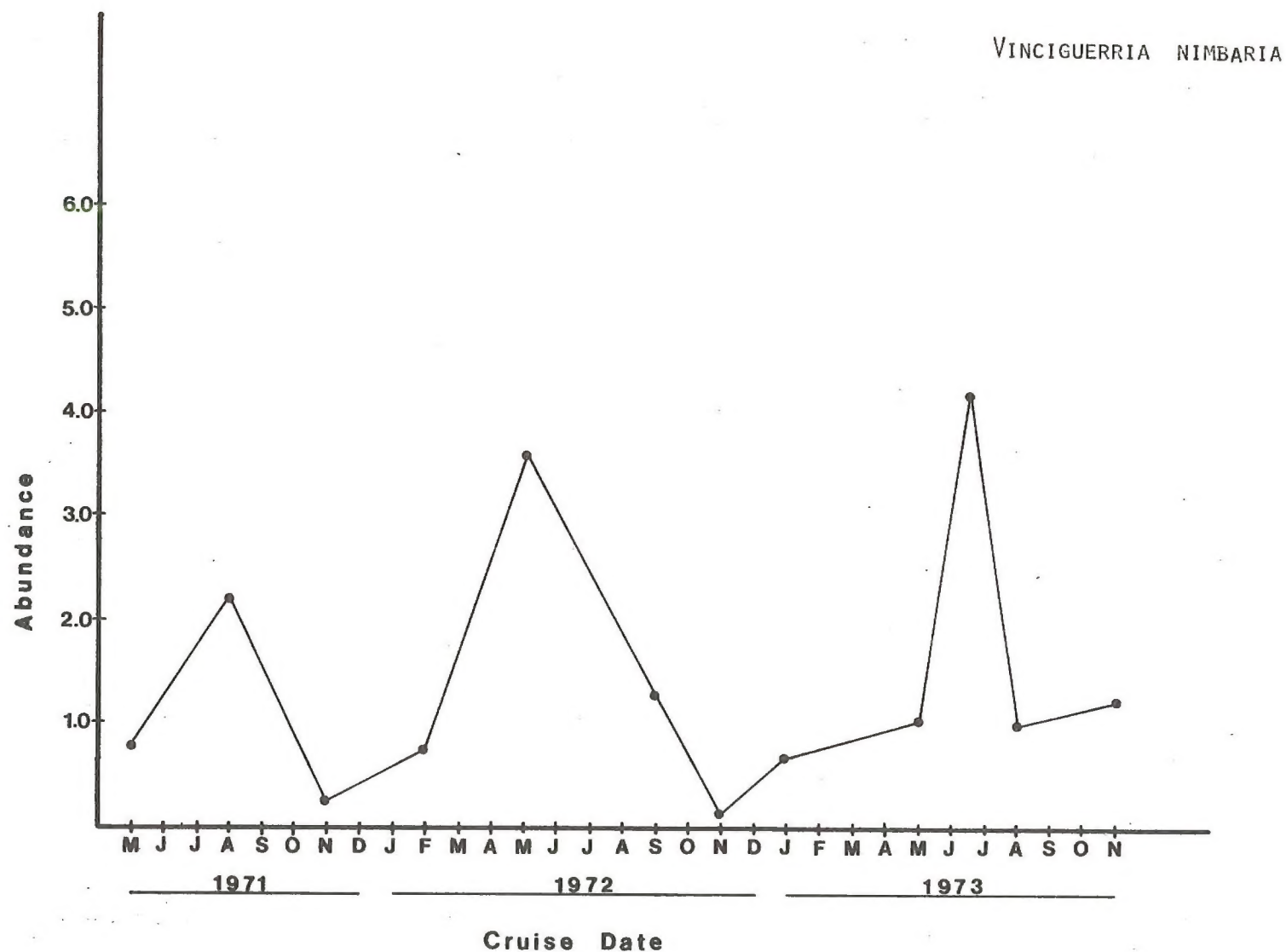


Fig. 25 Estimated mean abundances (number under 10 m² of sea surface) of Vinciguerria nimbaria larvae in the eastern Gulf of Mexico, 1971-1974.

VINCIGUERRIA POWERIAE

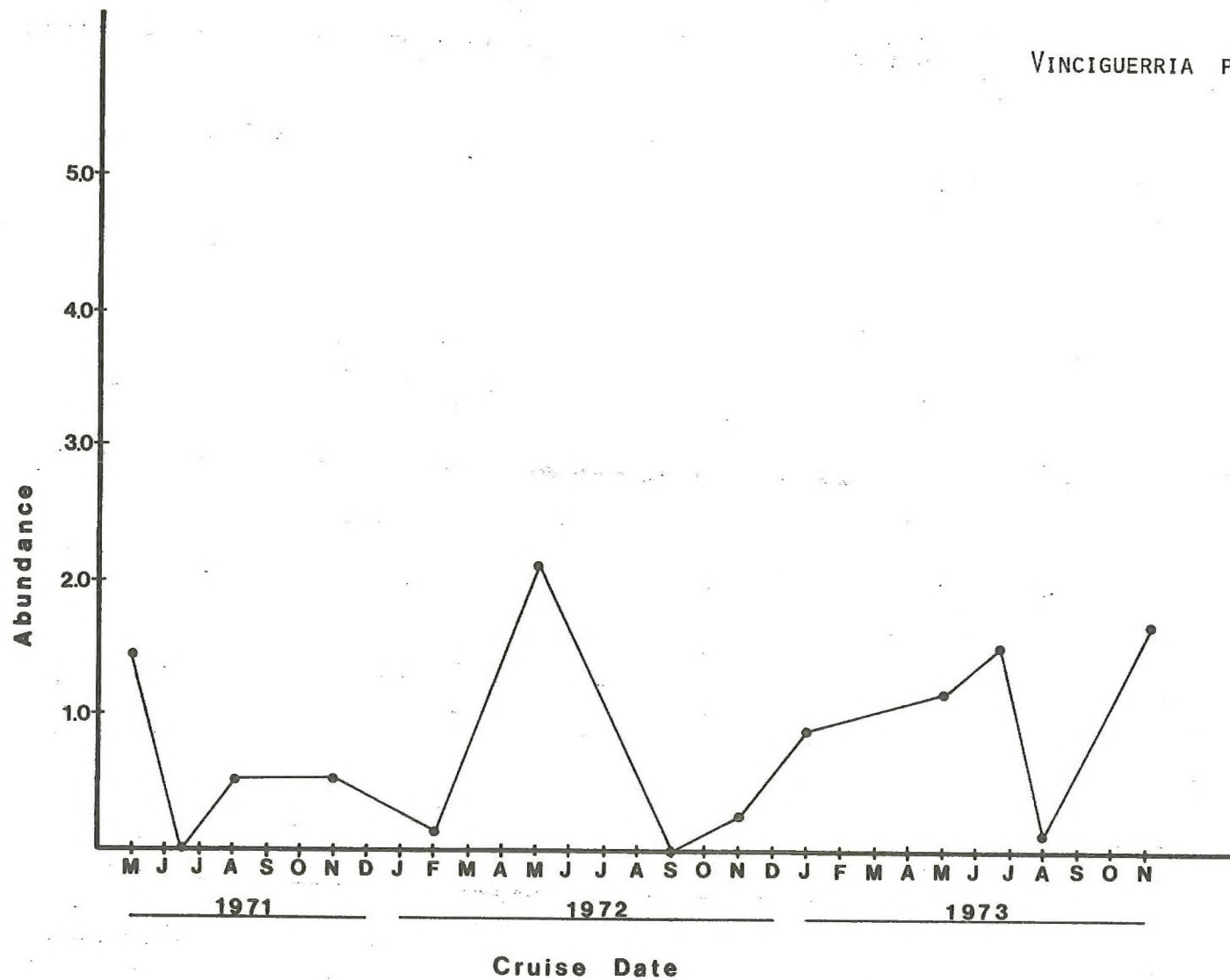


Fig. 26

Estimated mean abundances (number under 10 m² of sea surface) of *Vinciguerria poweriae* larvae in the eastern Gulf of Mexico, 1971-1974.

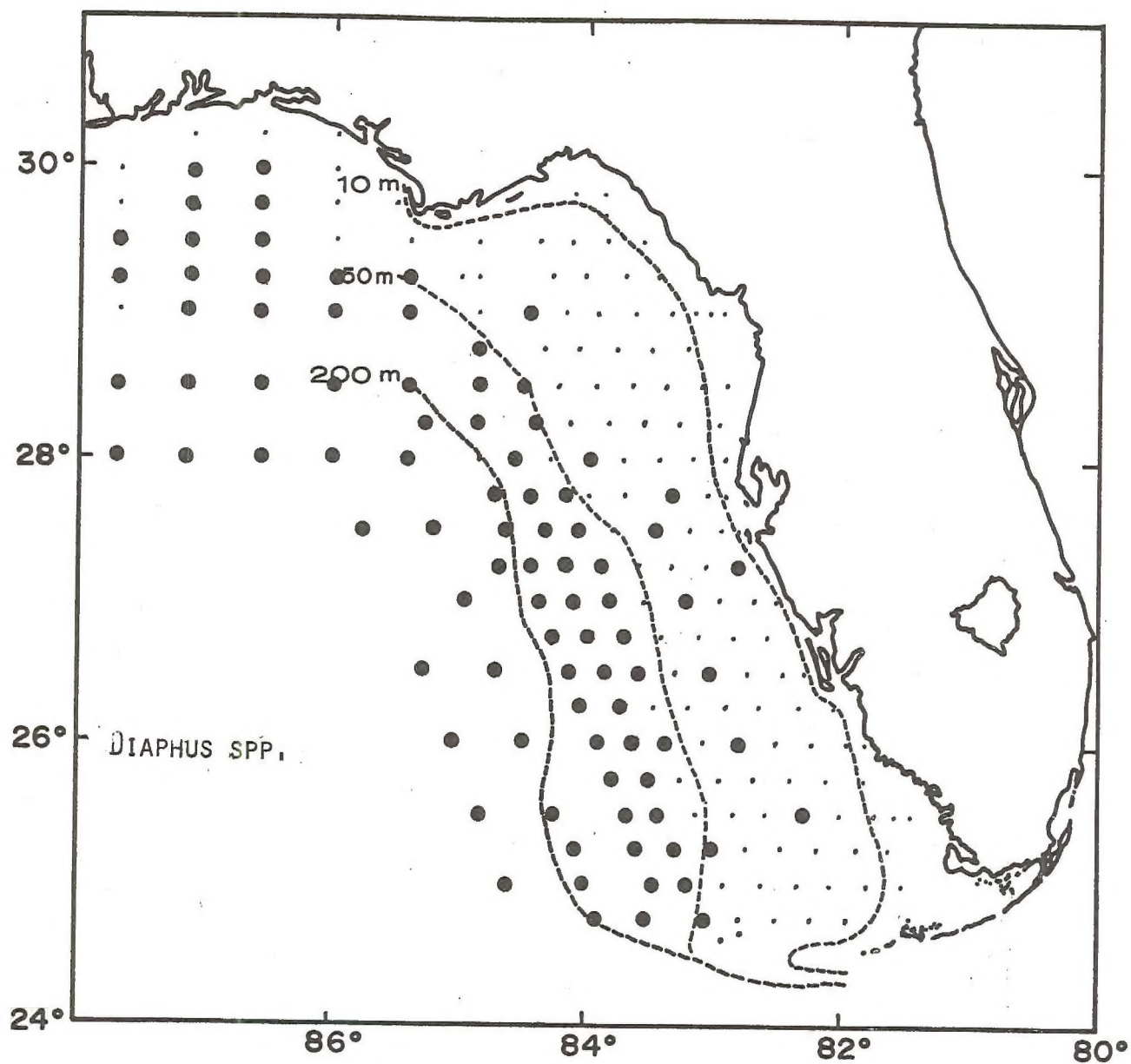


Fig. 27 Stations at which *Diaphus* spp. larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

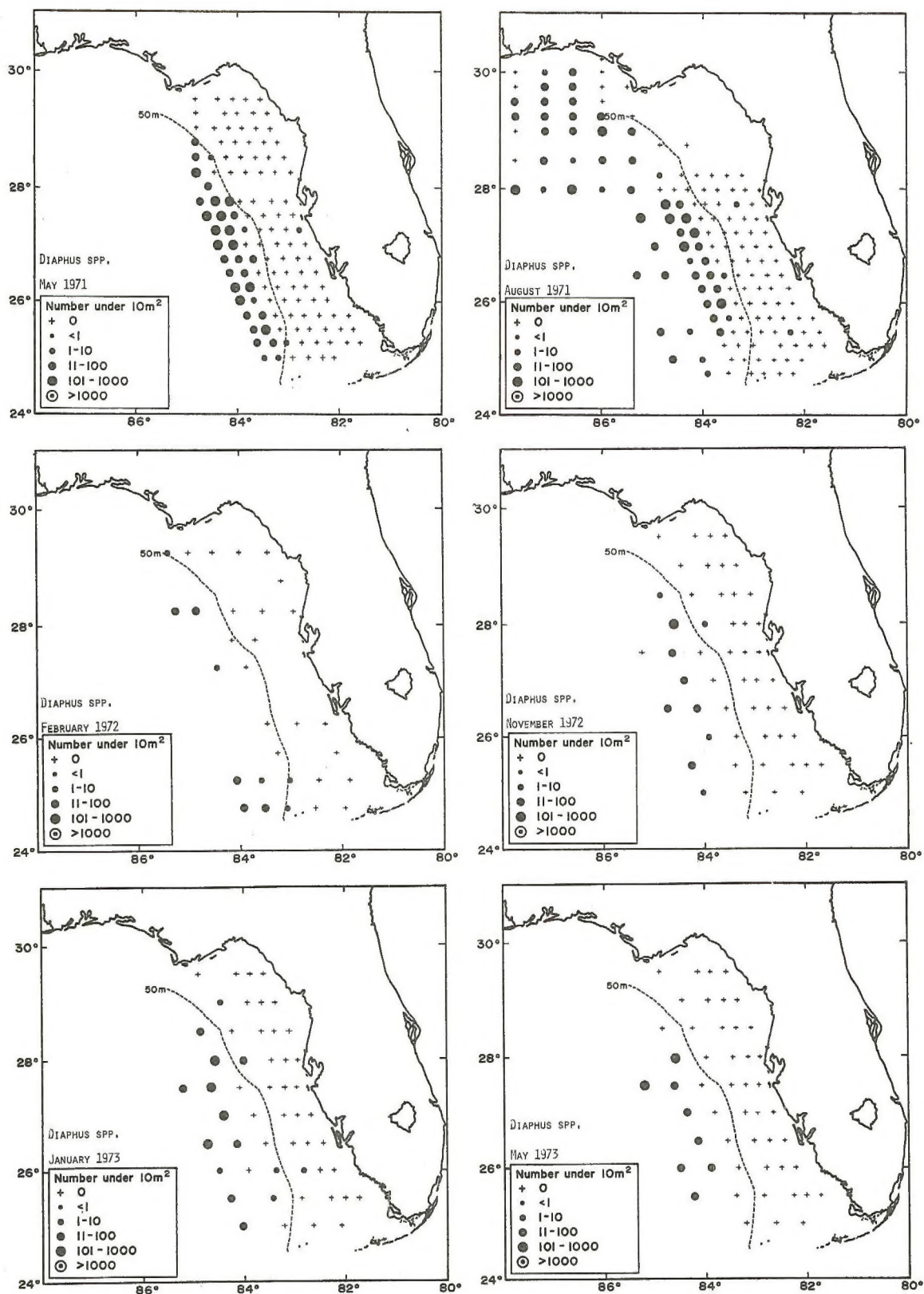


Fig. 28

Distribution and abundance of *Diaphus* spp. larvae in the eastern Gulf of Mexico, 1971-1974.

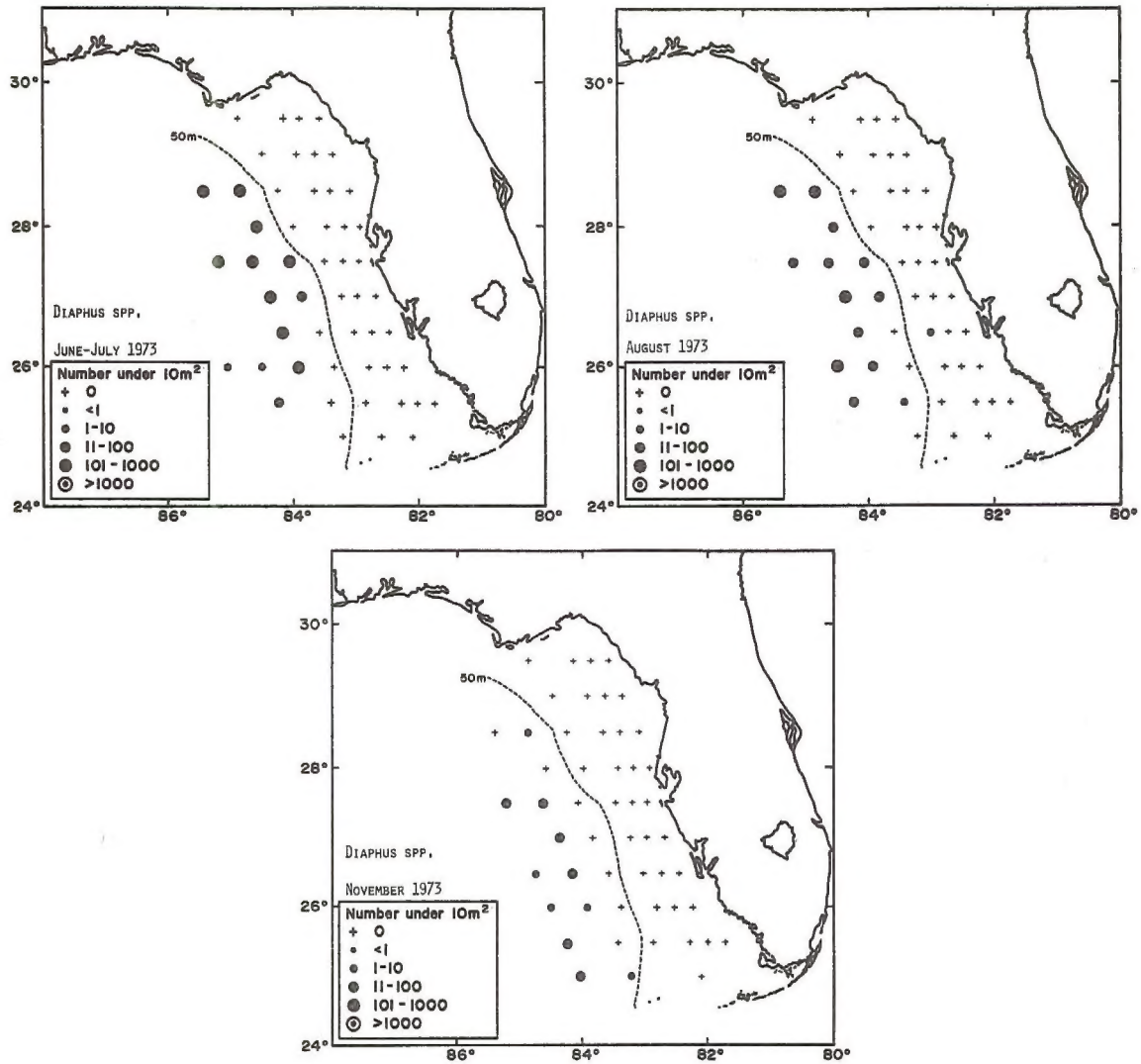


Fig. 28

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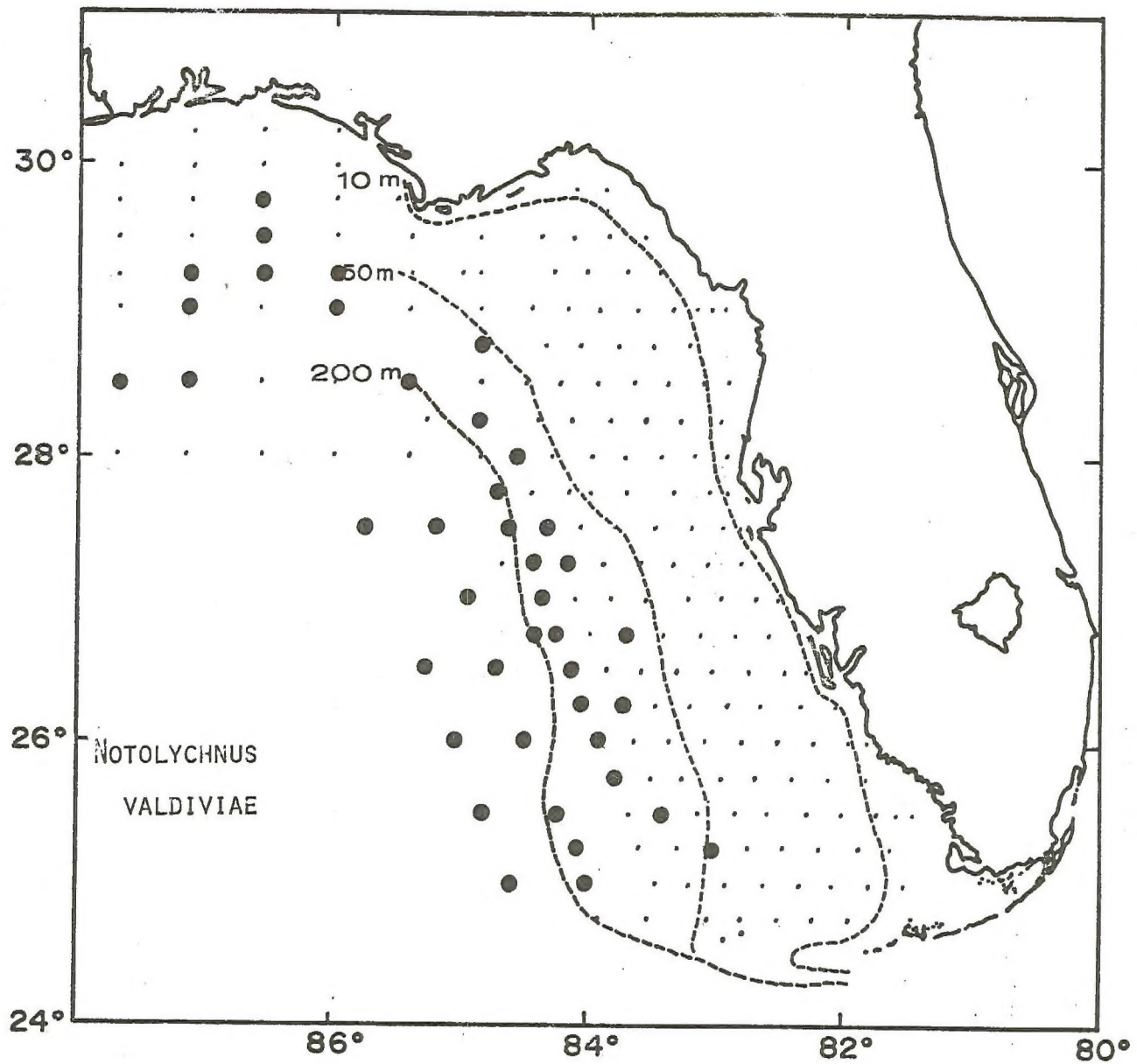


Fig. 29

Stations at which Notolychnus valdiviae larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

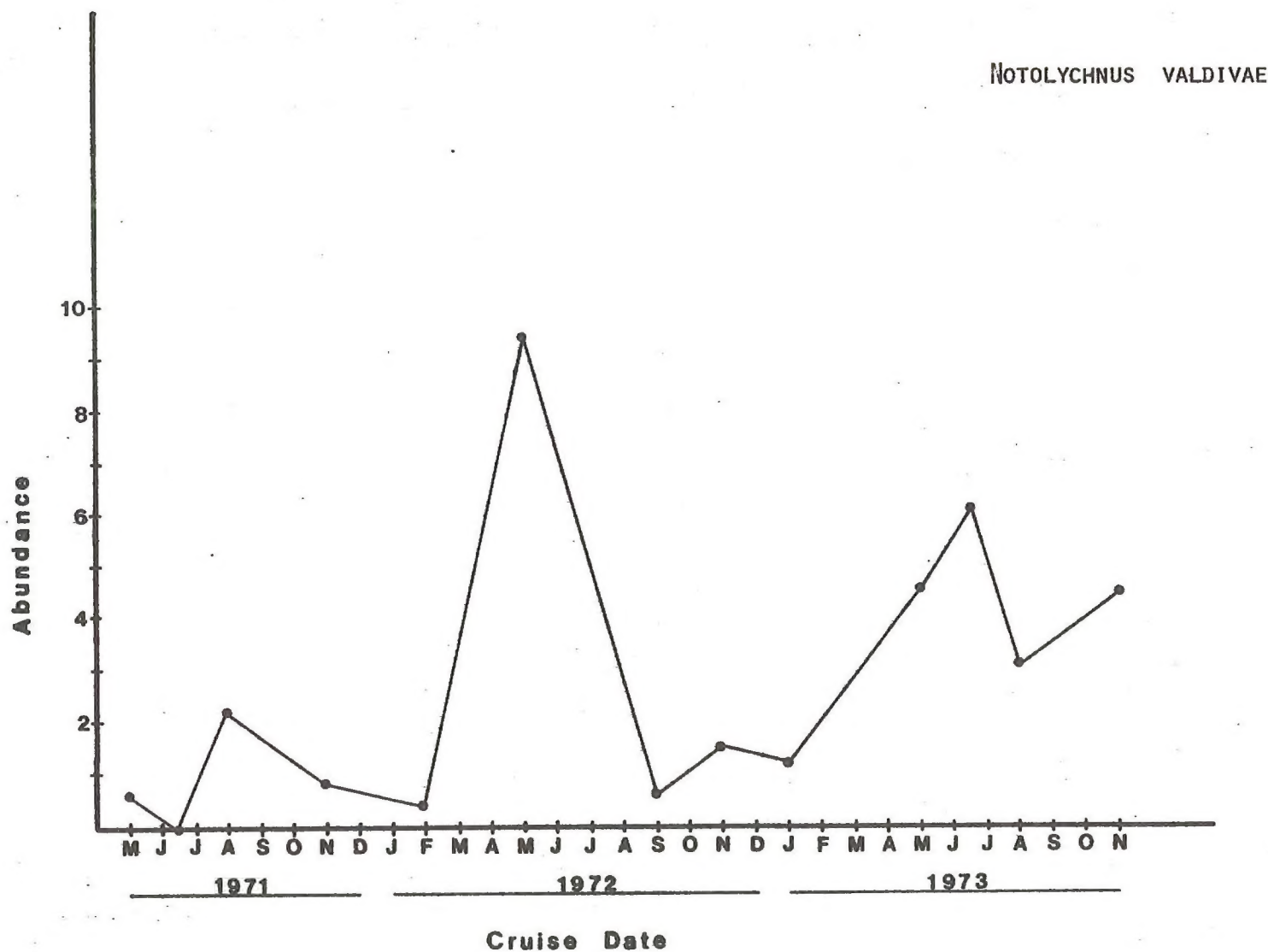


Fig. 30

Estimated mean abundances (number under 10 m² of sea surface) of *Notolychnus valdiviae* larvae in the eastern Gulf of Mexico, 1971-1974.

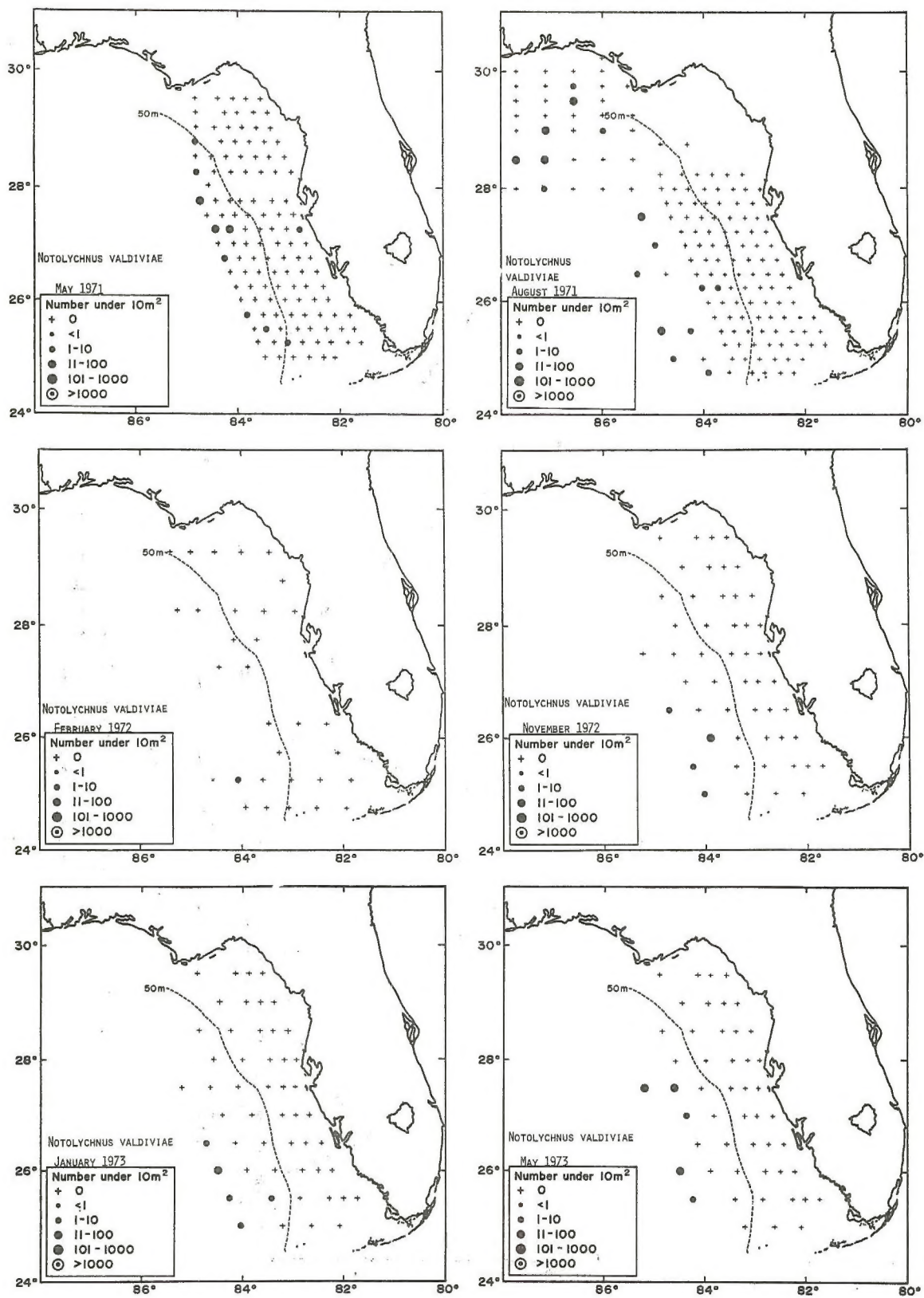


Fig. 31

Distribution and abundance of *Notolychnus valdiviae* larvae in the eastern Gulf of Mexico, 1971-1974.

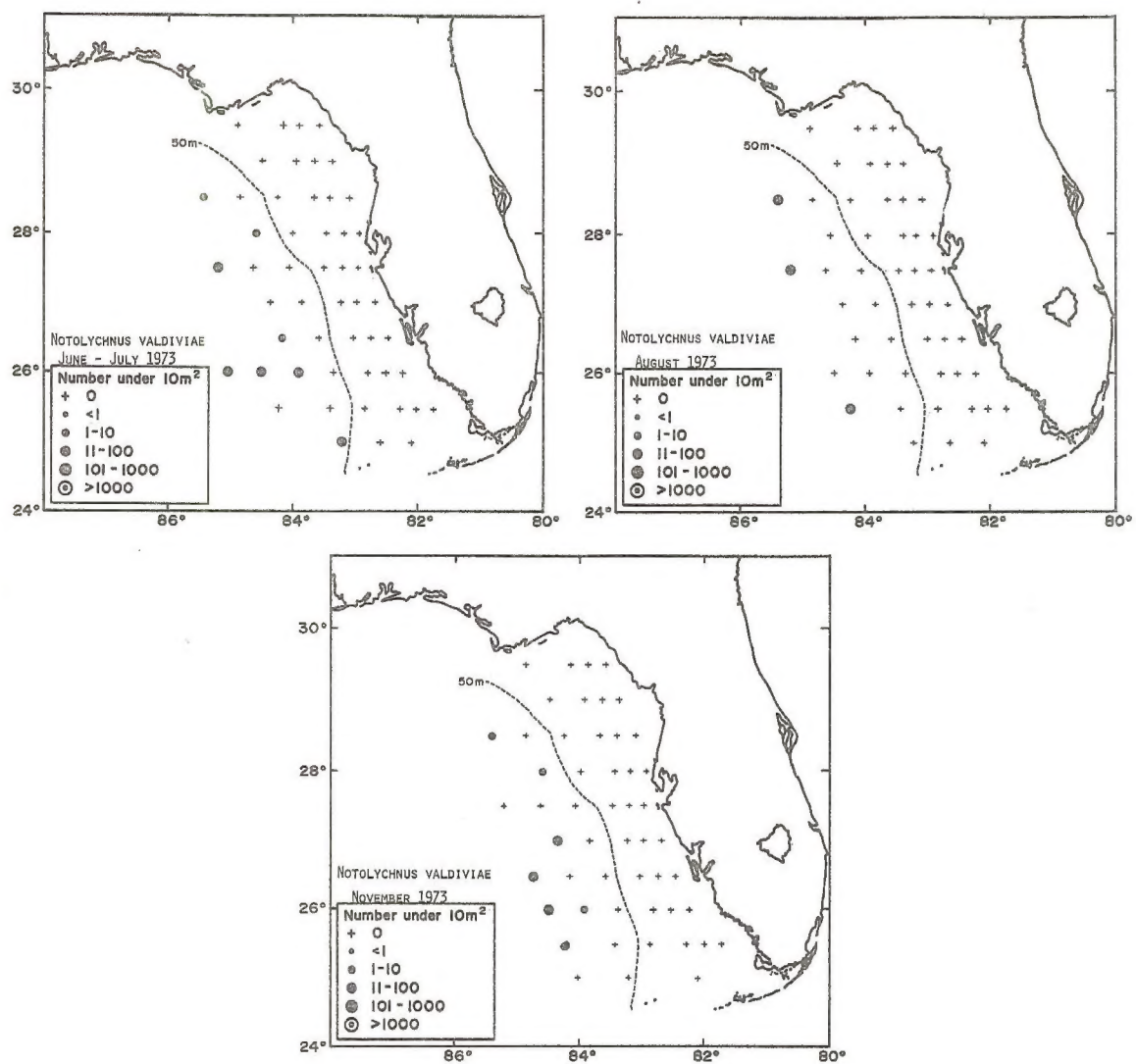


Fig. 31

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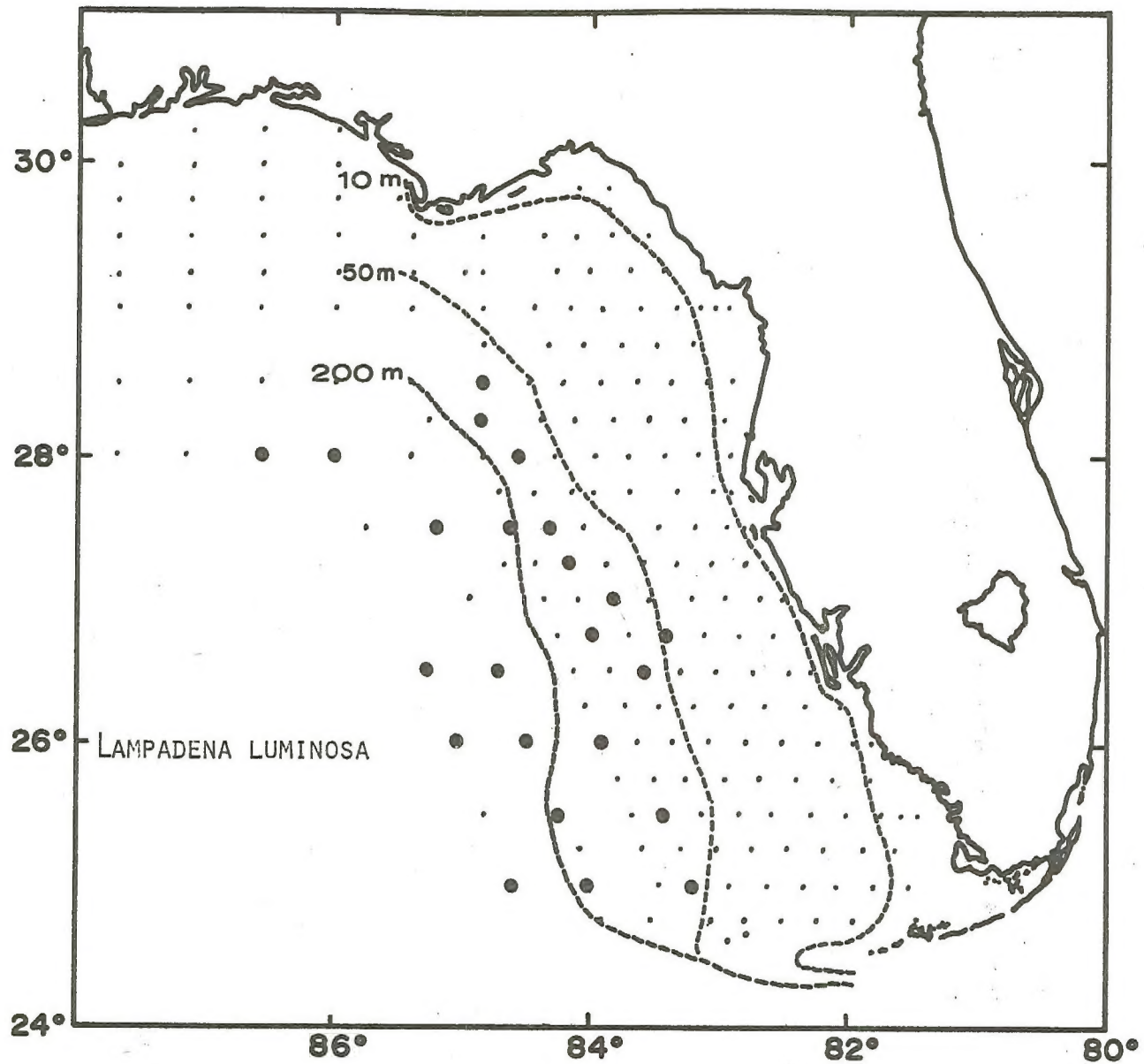


Fig. 32

Stations at which *Lampadena luminosa* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

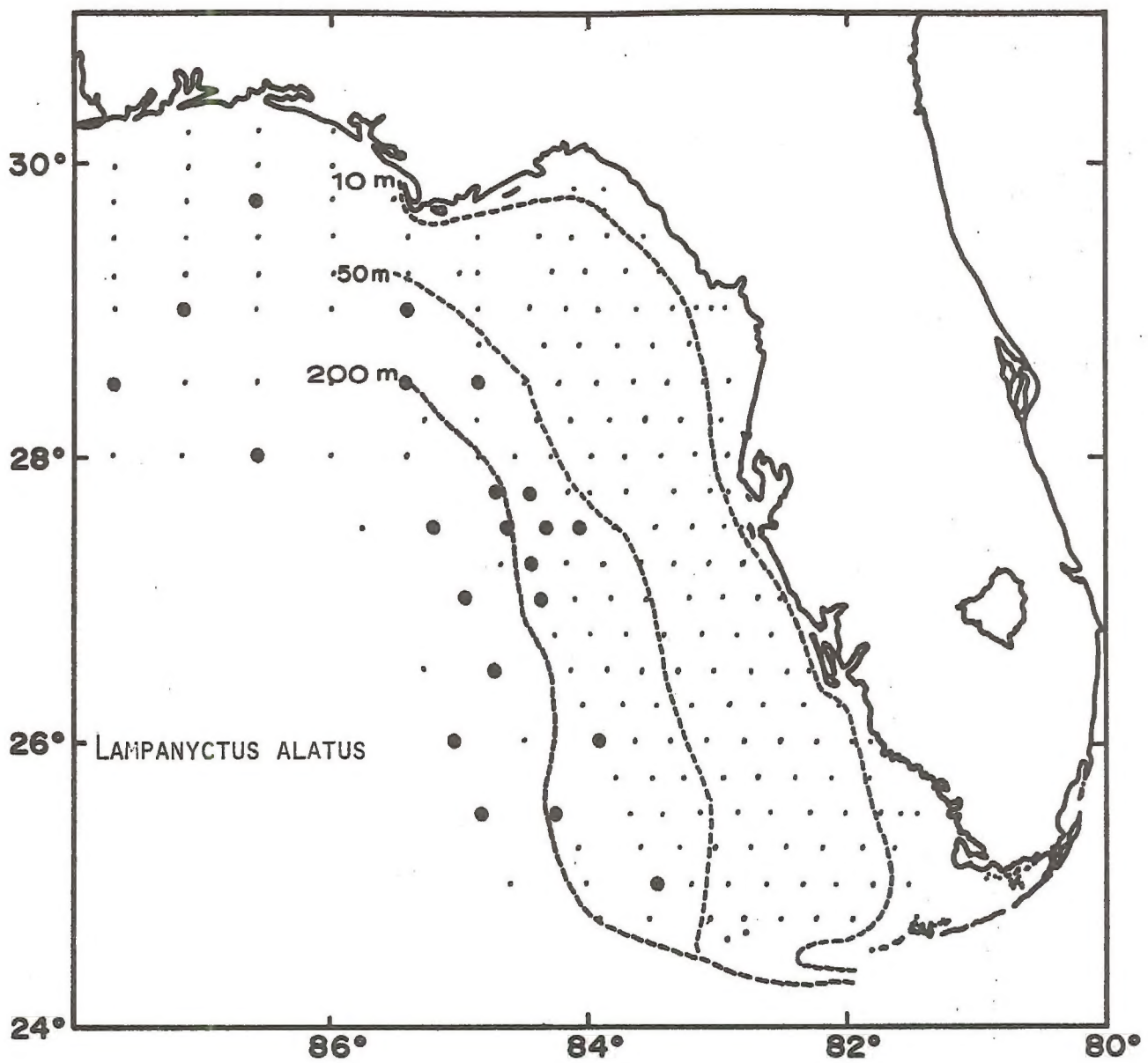


Fig. 33 Stations at which *Lampanyctus alatus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

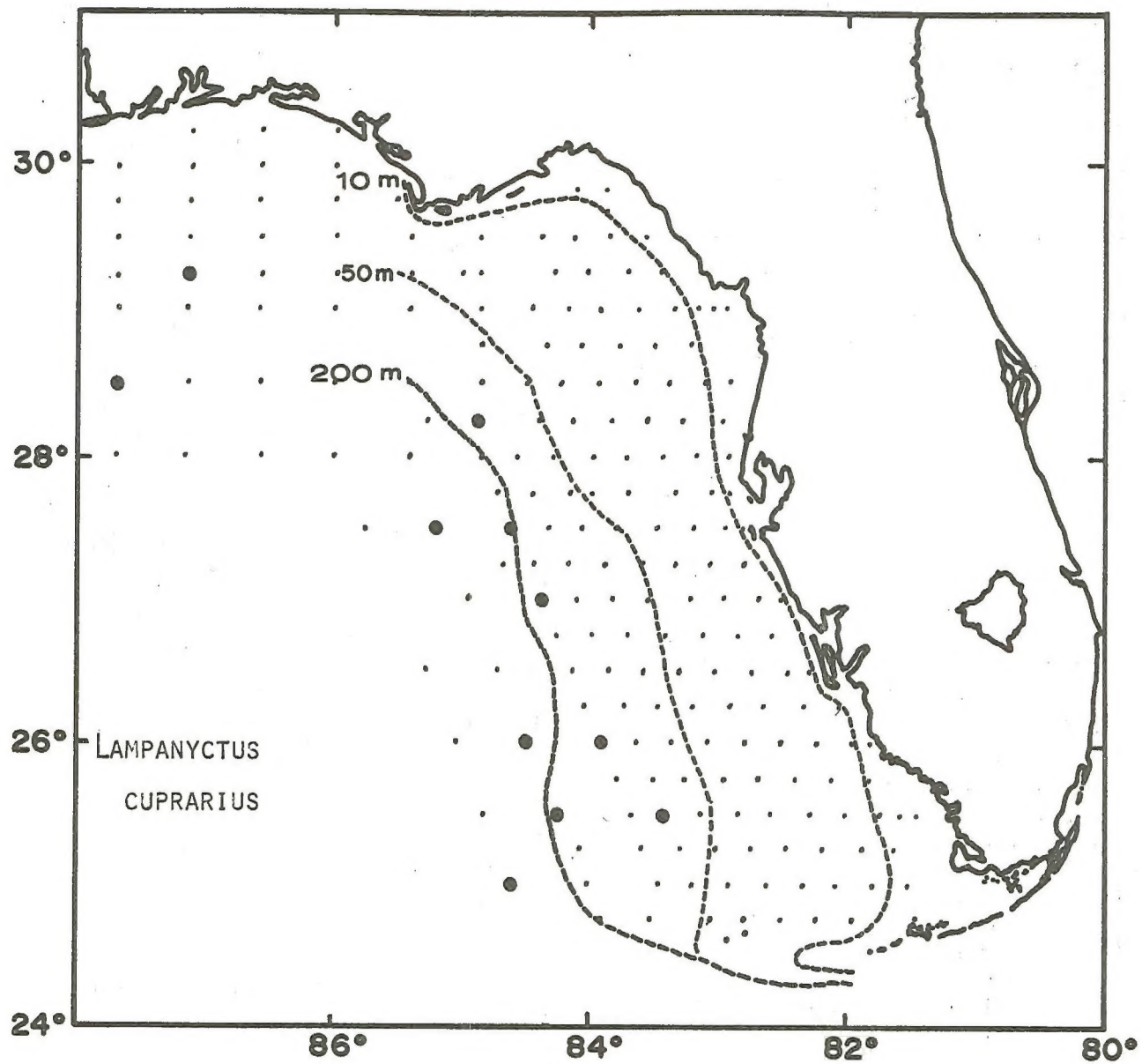


Fig. 34 Stations at which *Lampanyctus cuprarius* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

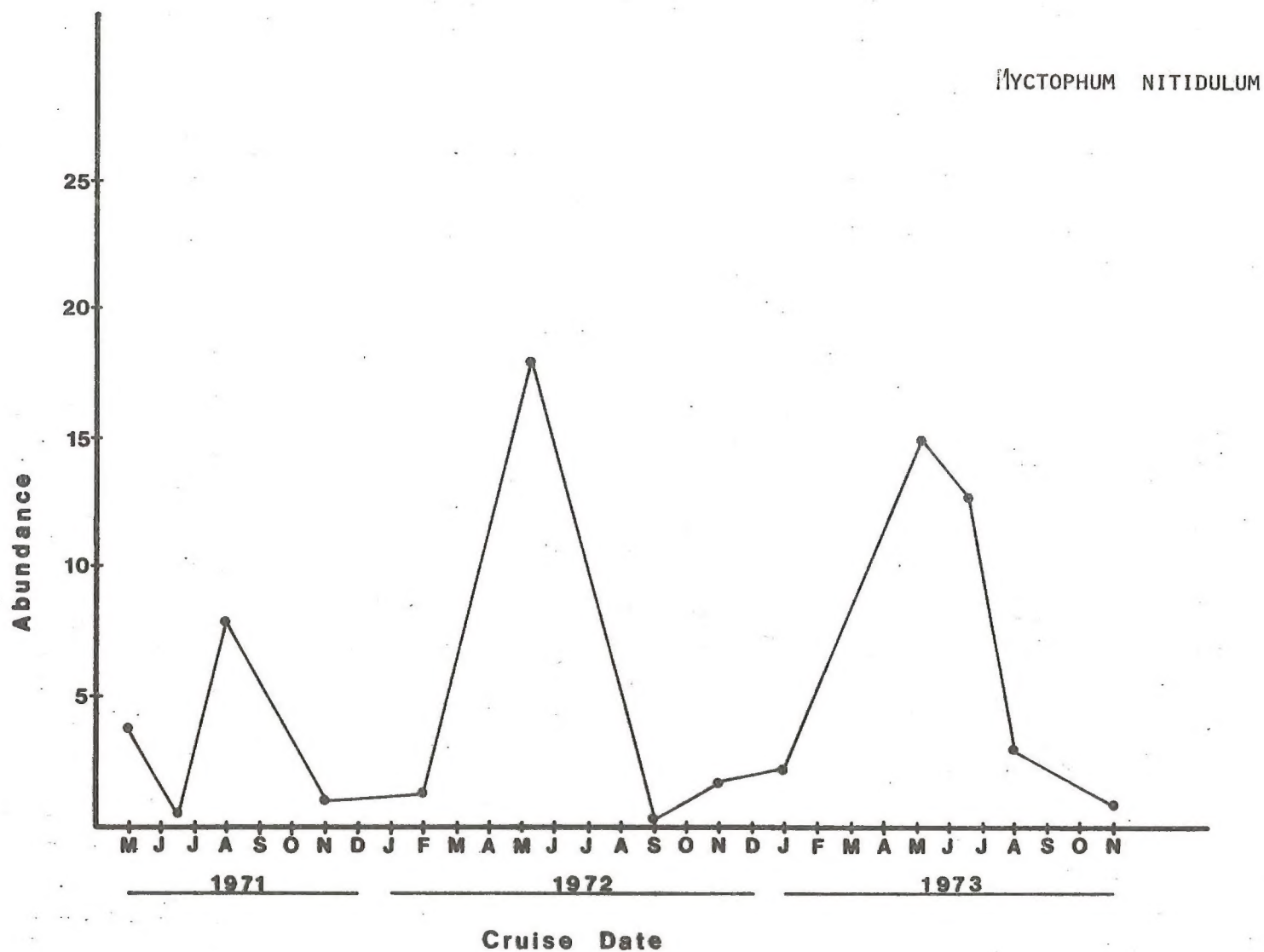


Fig. 35

Estimated mean abundances (number under 10 m² of sea surface) of Myctophum nitidulum larvae in the eastern Gulf of Mexico, 1971-1974.

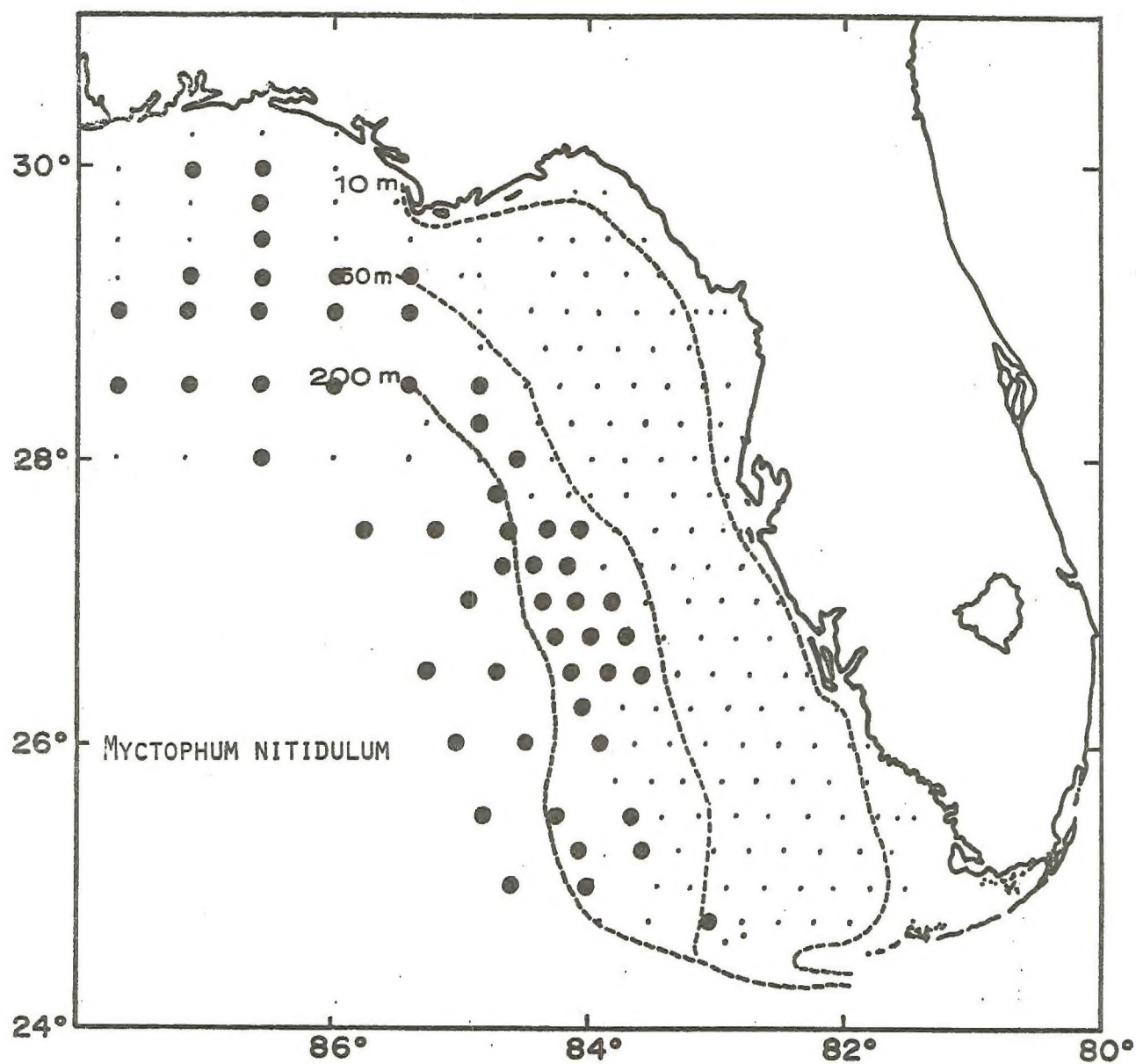


Fig. 36

Stations at which *Myctophum nitidulum* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

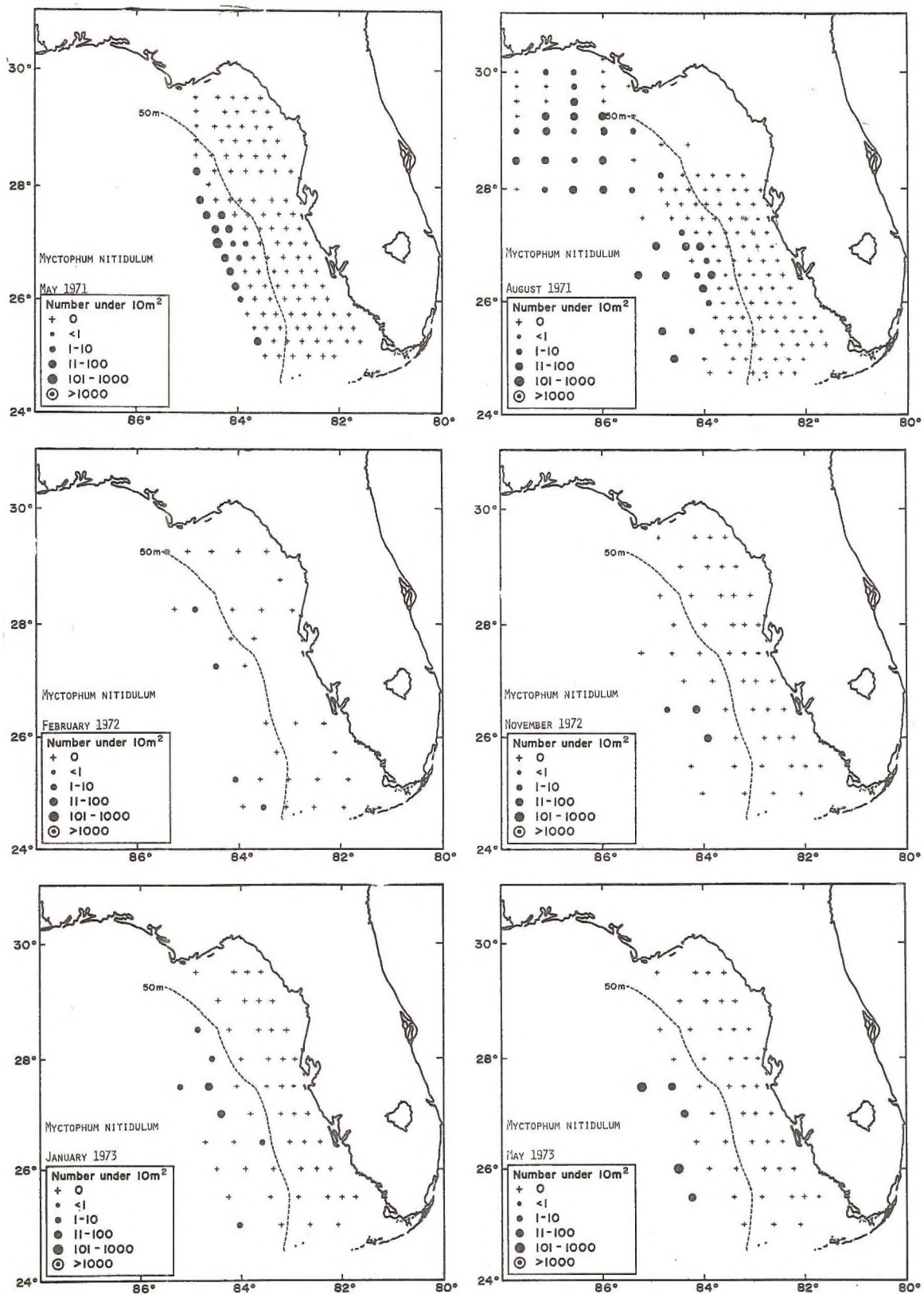


Fig. 37 Distribution and abundance of *Myctophum nitidulum* larvae in the eastern Gulf of Mexico, 1971-1974.

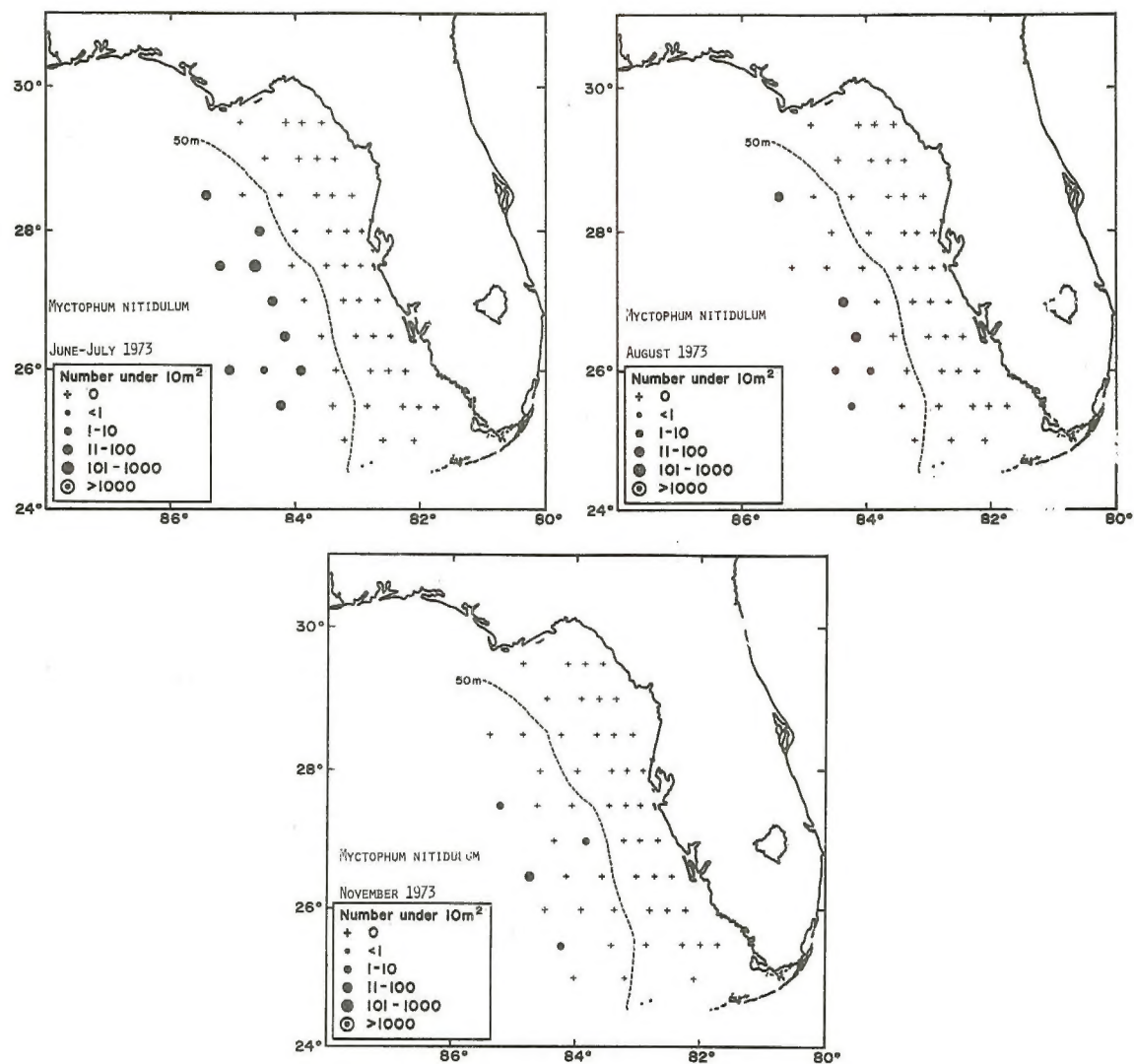


Fig. 37

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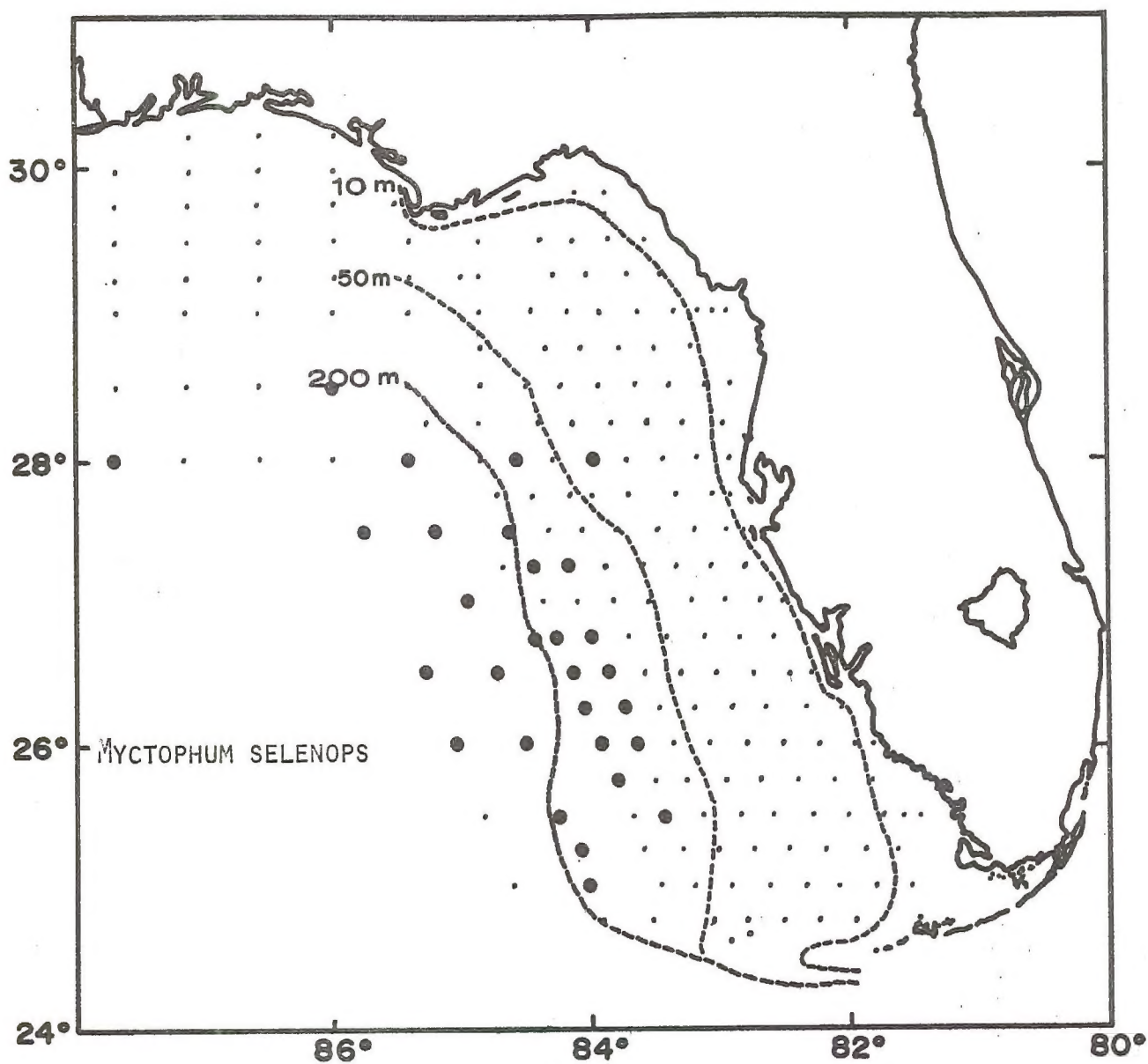


Fig. 38

Stations at which *Myctophum selenops* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

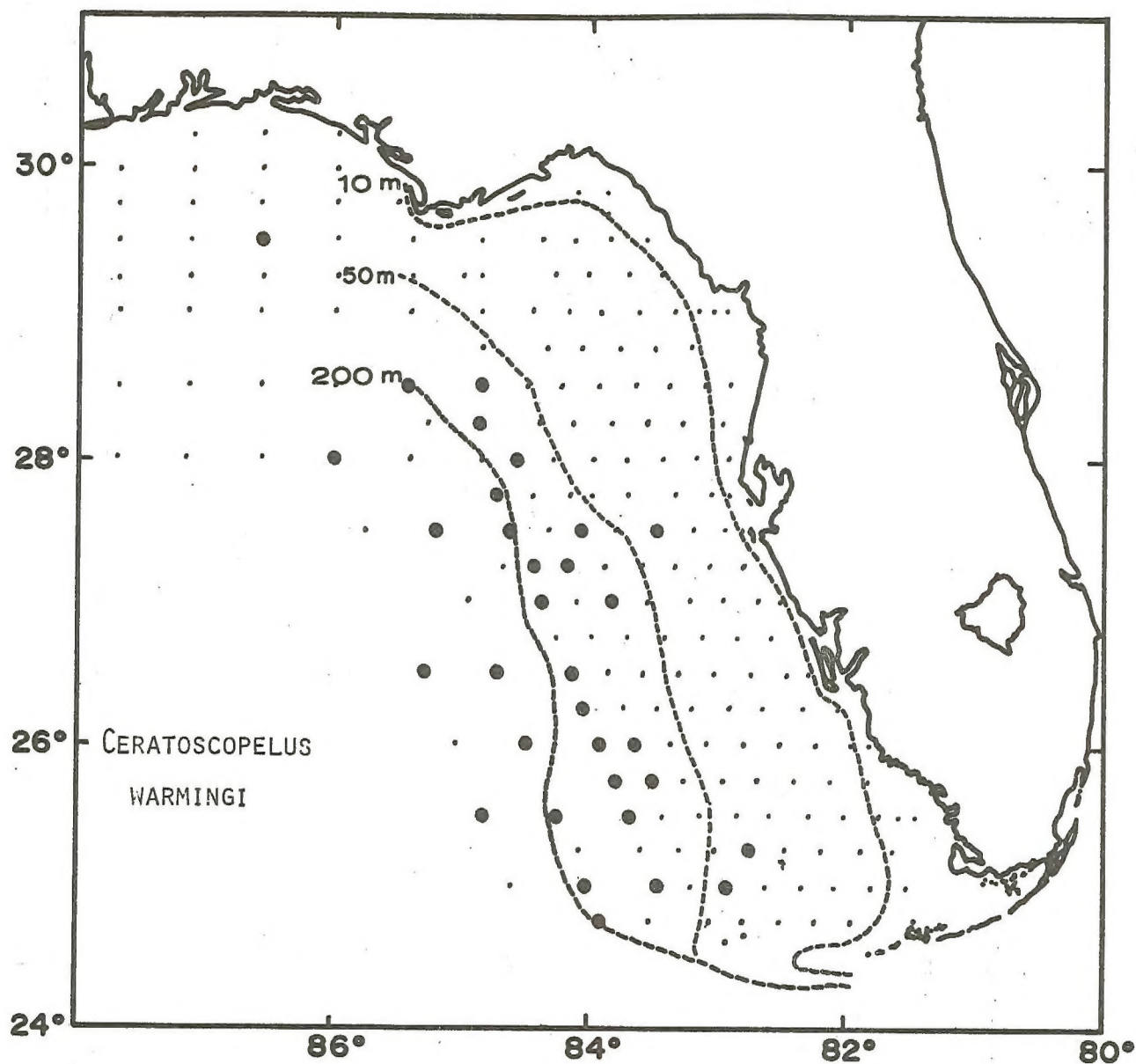


Fig. 39 Stations at which *Cetatoscopelus warmingi* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

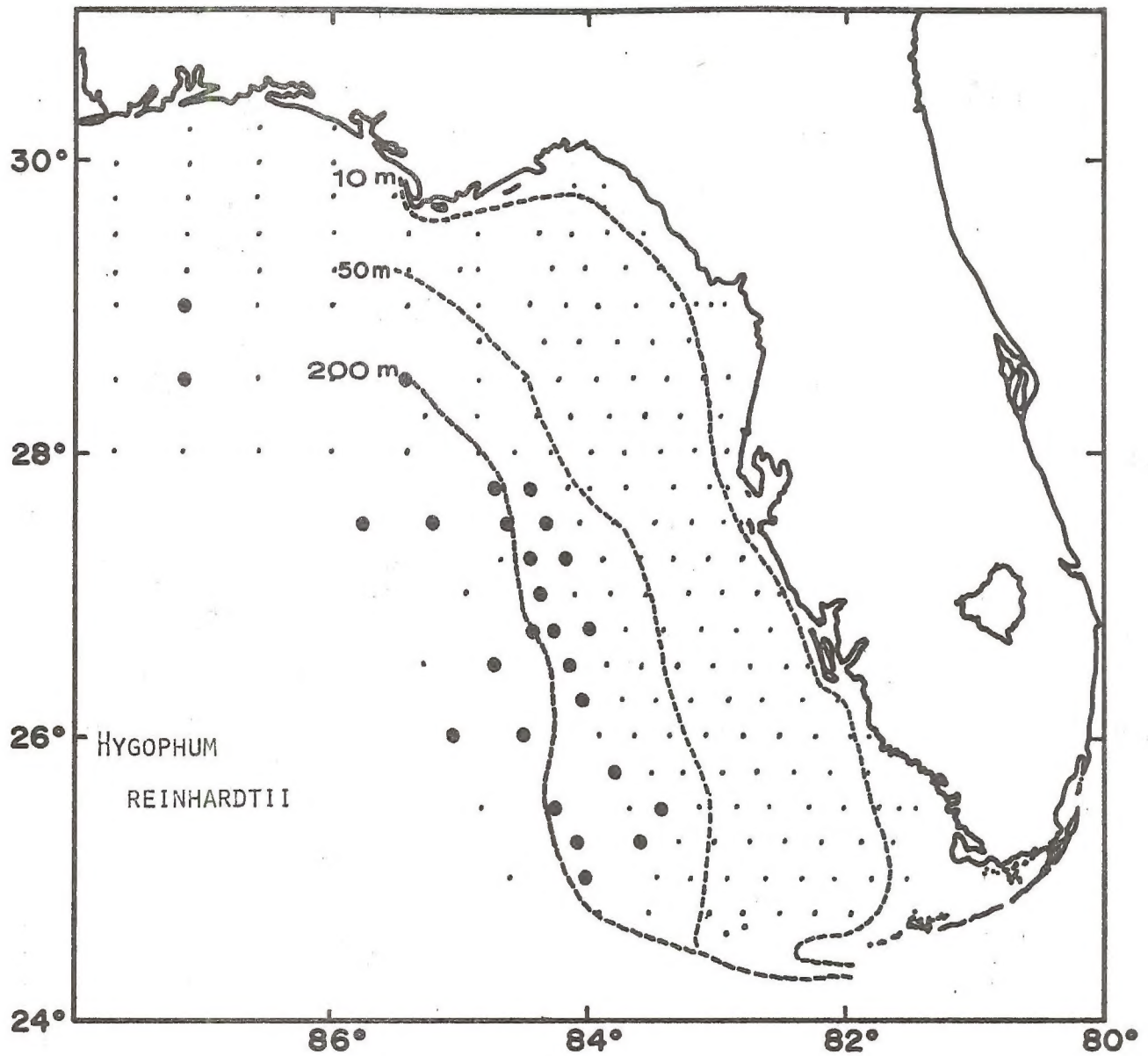


Fig. 40 Stations at which Hygophum reinhardtii larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

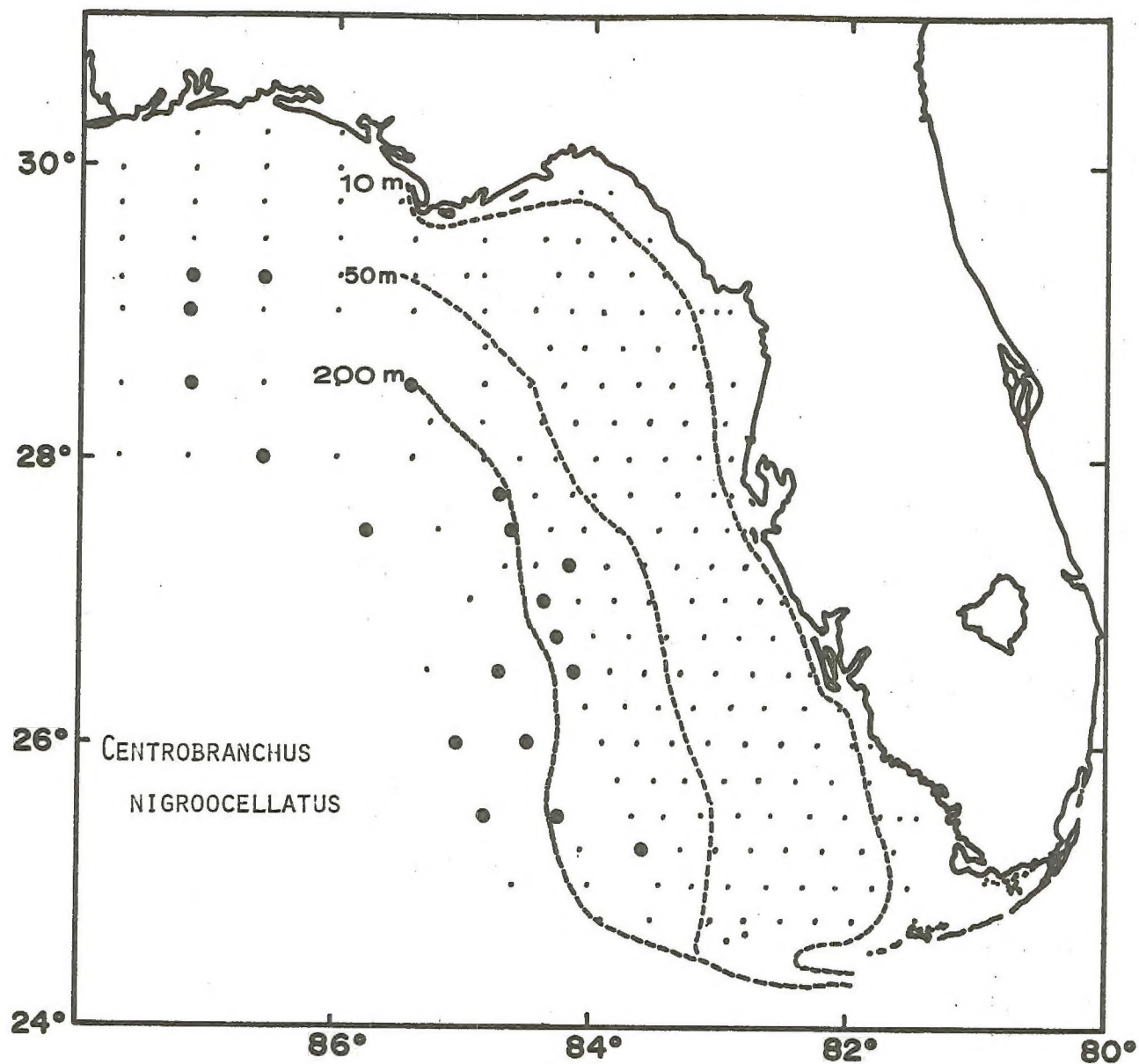


Fig. 41 Stations at which Centrobranchus nigroocellatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

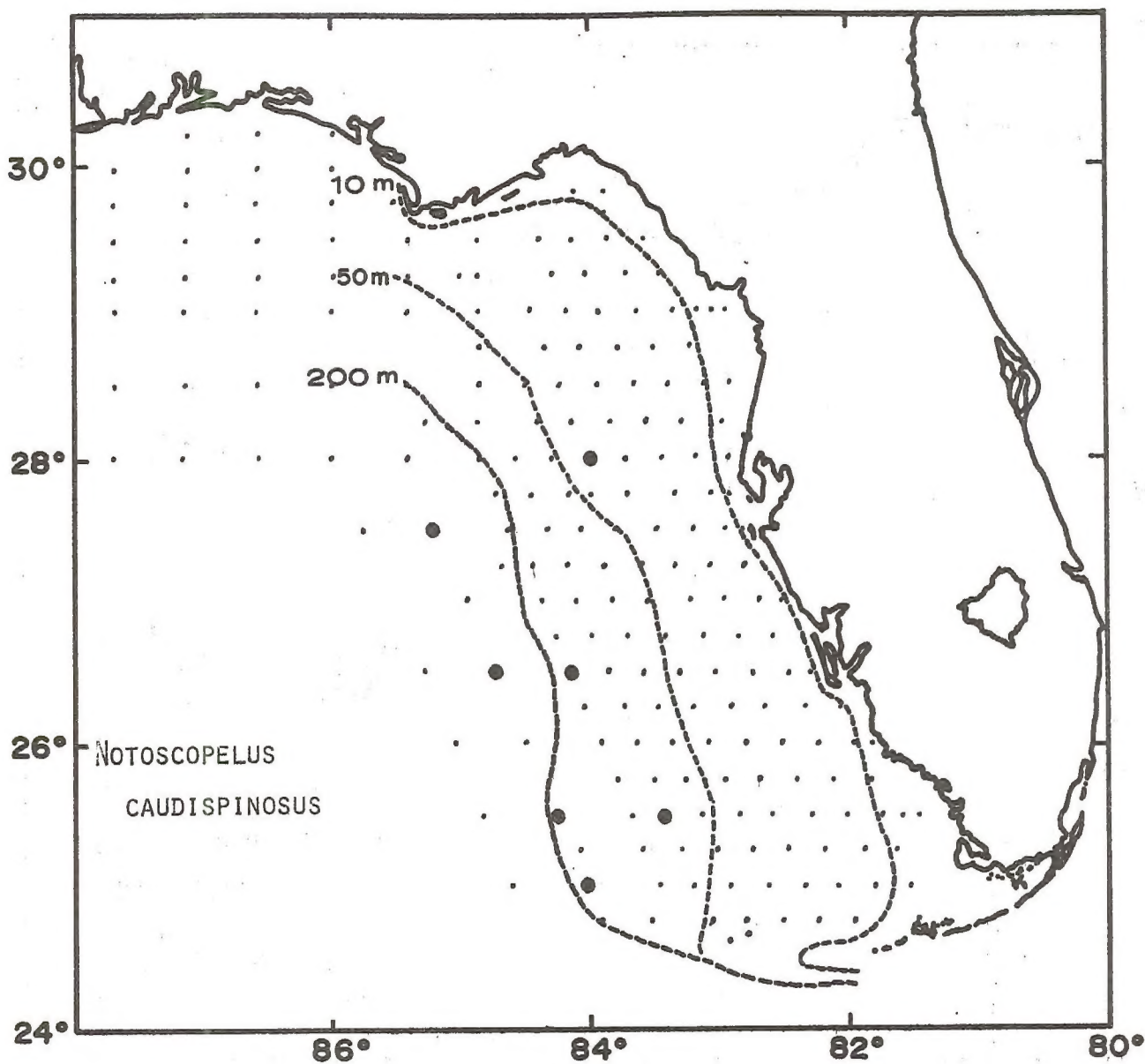


Fig. 42

Stations at which *Notoscopelus caudispinosus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

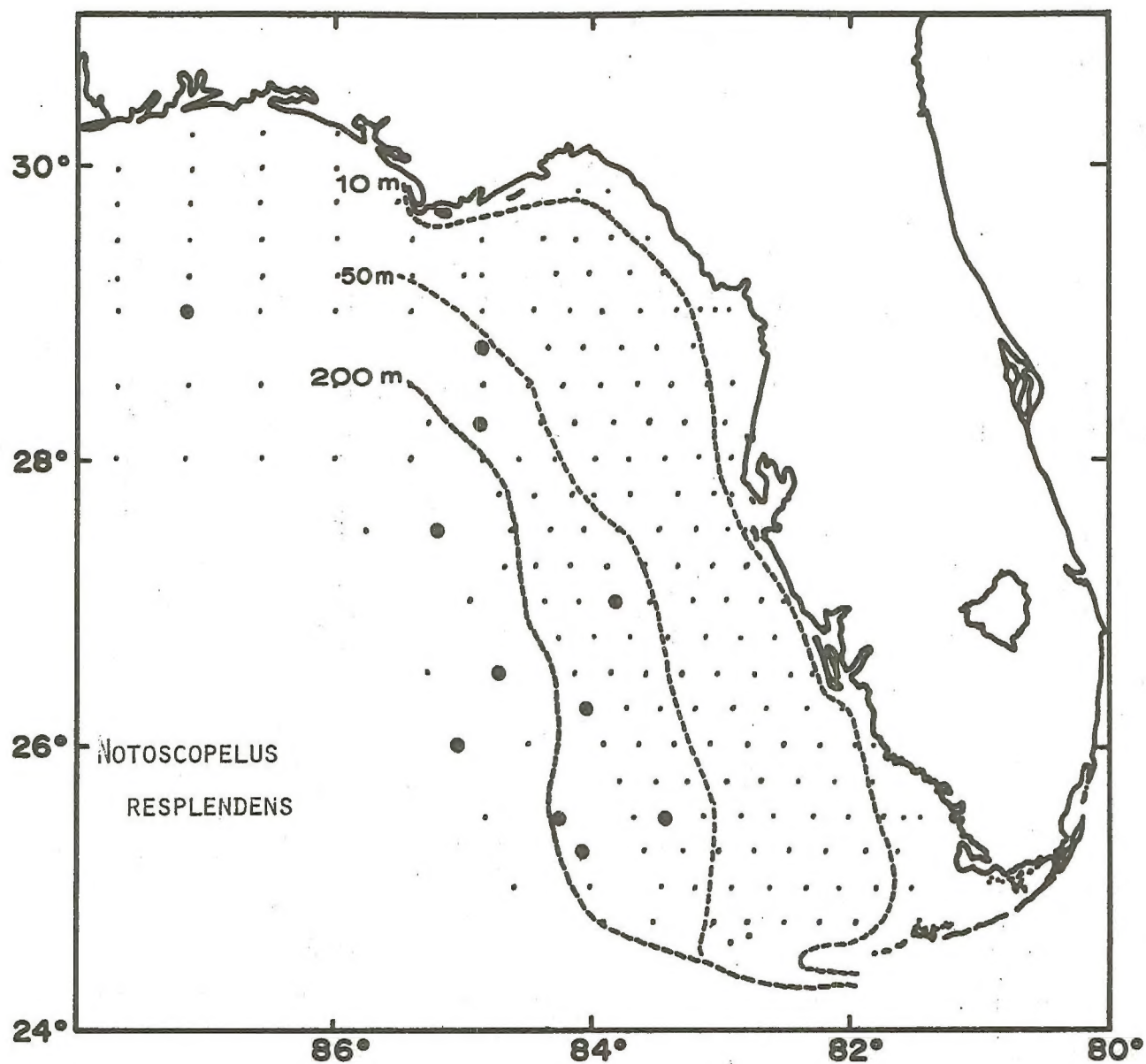


Fig. 43 Stations at which *Notoscopelus resplendens* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

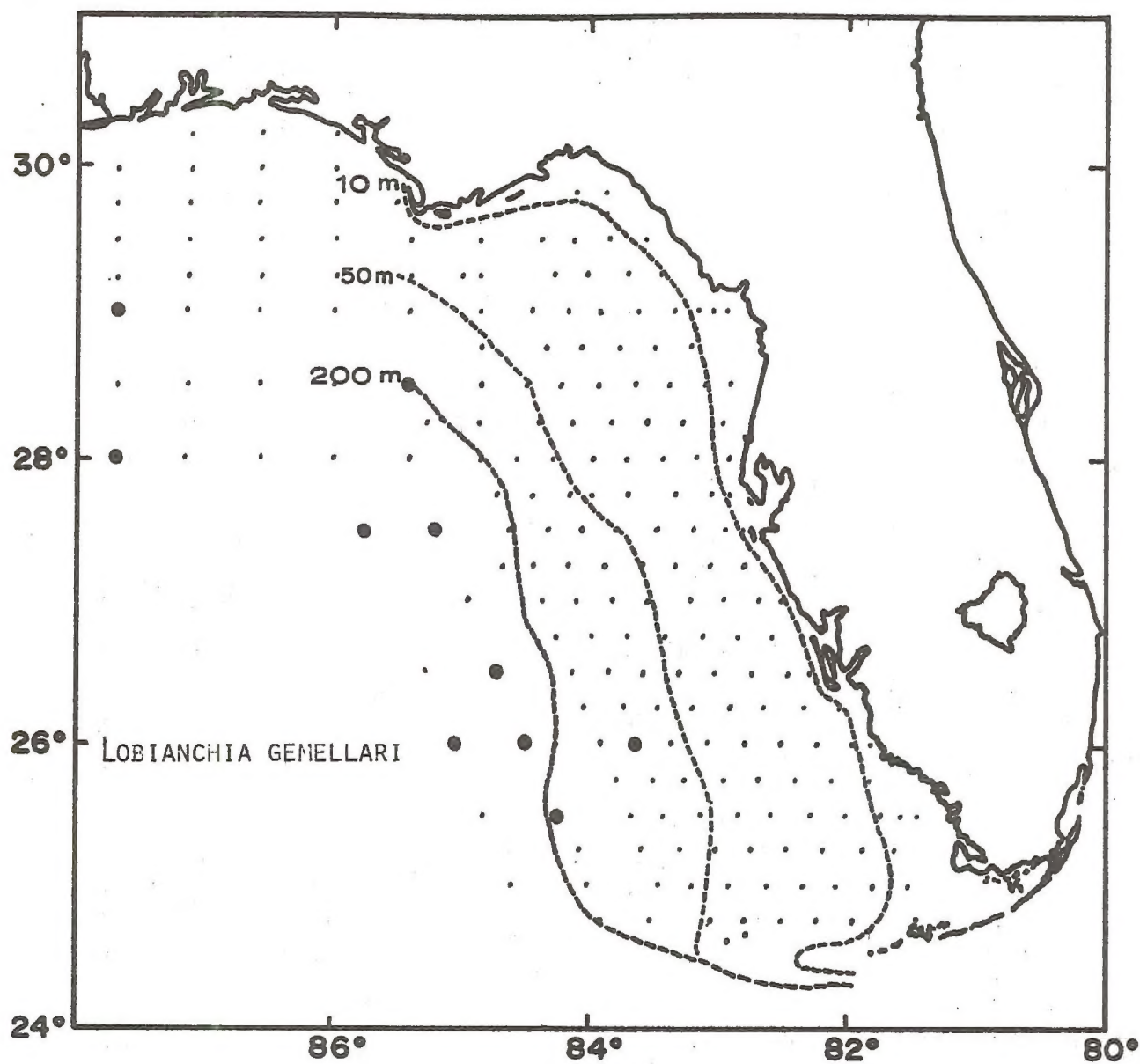


Fig. 44 Stations at which *Lobiancha gemellari* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

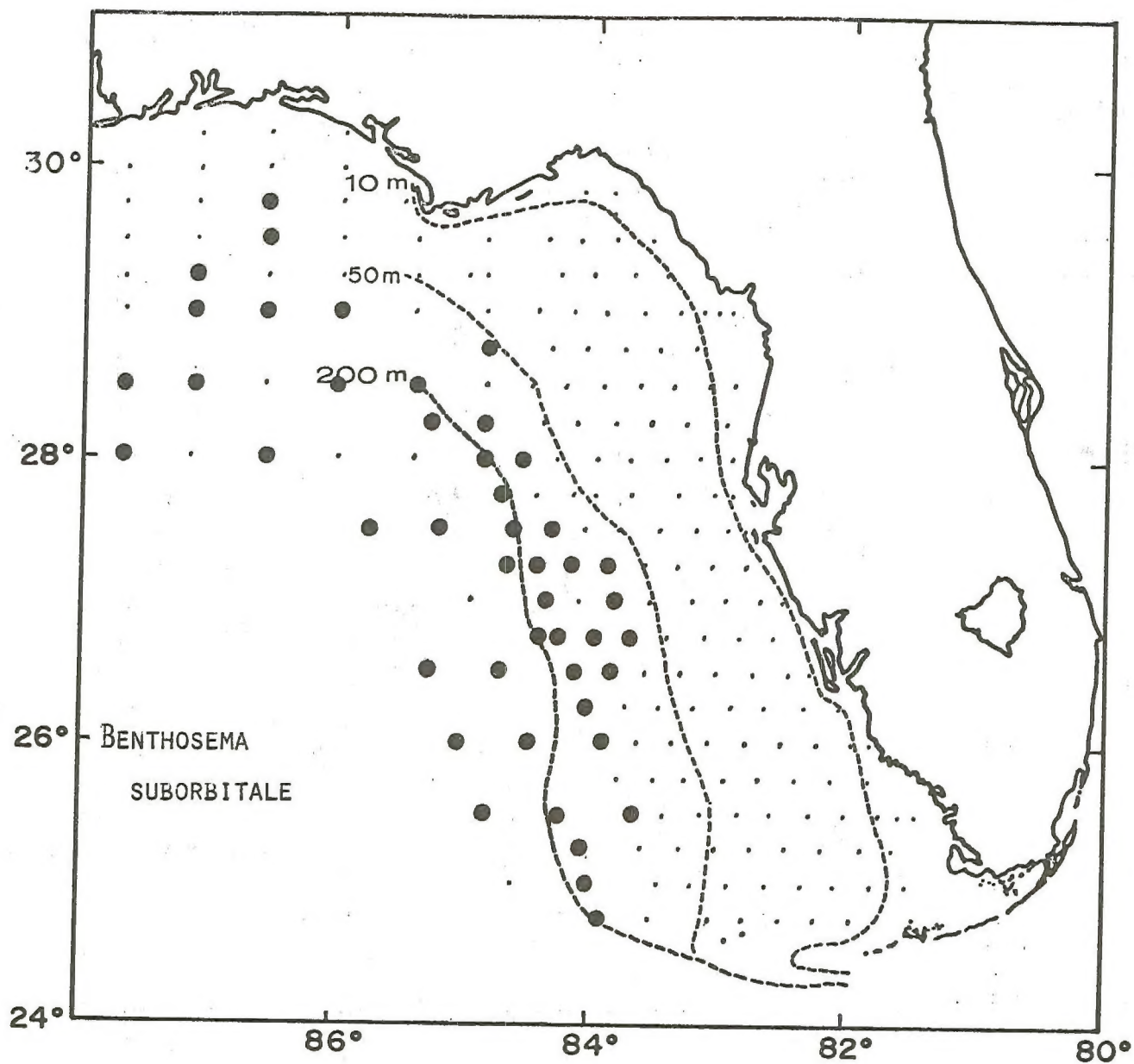


Fig. 45

Stations at which *Benthosema suborbitale* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

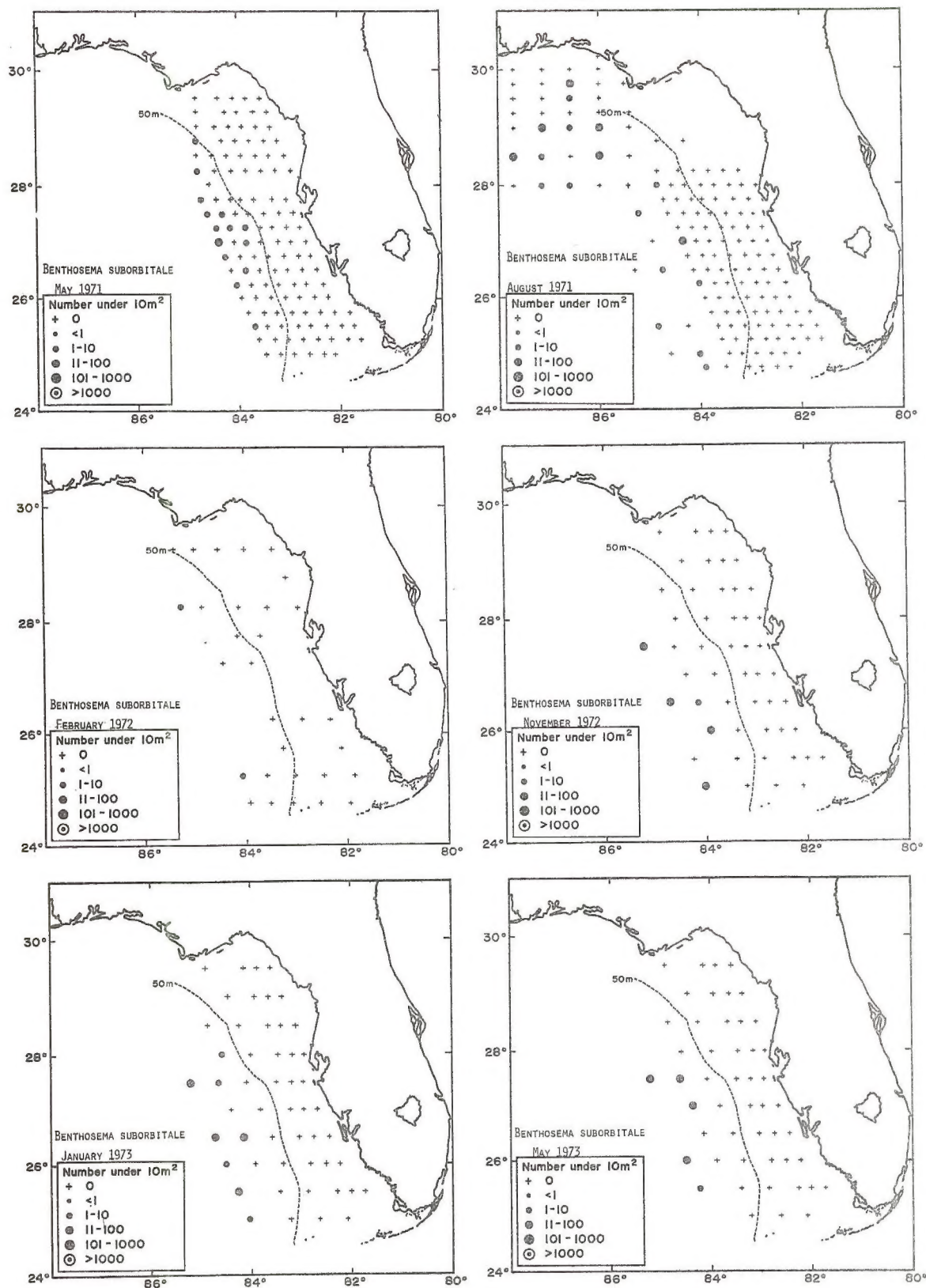


Fig. 46

Distribution and abundance of Benthosema suborbitale larvae in the eastern Gulf of Mexico, 1971-1974.

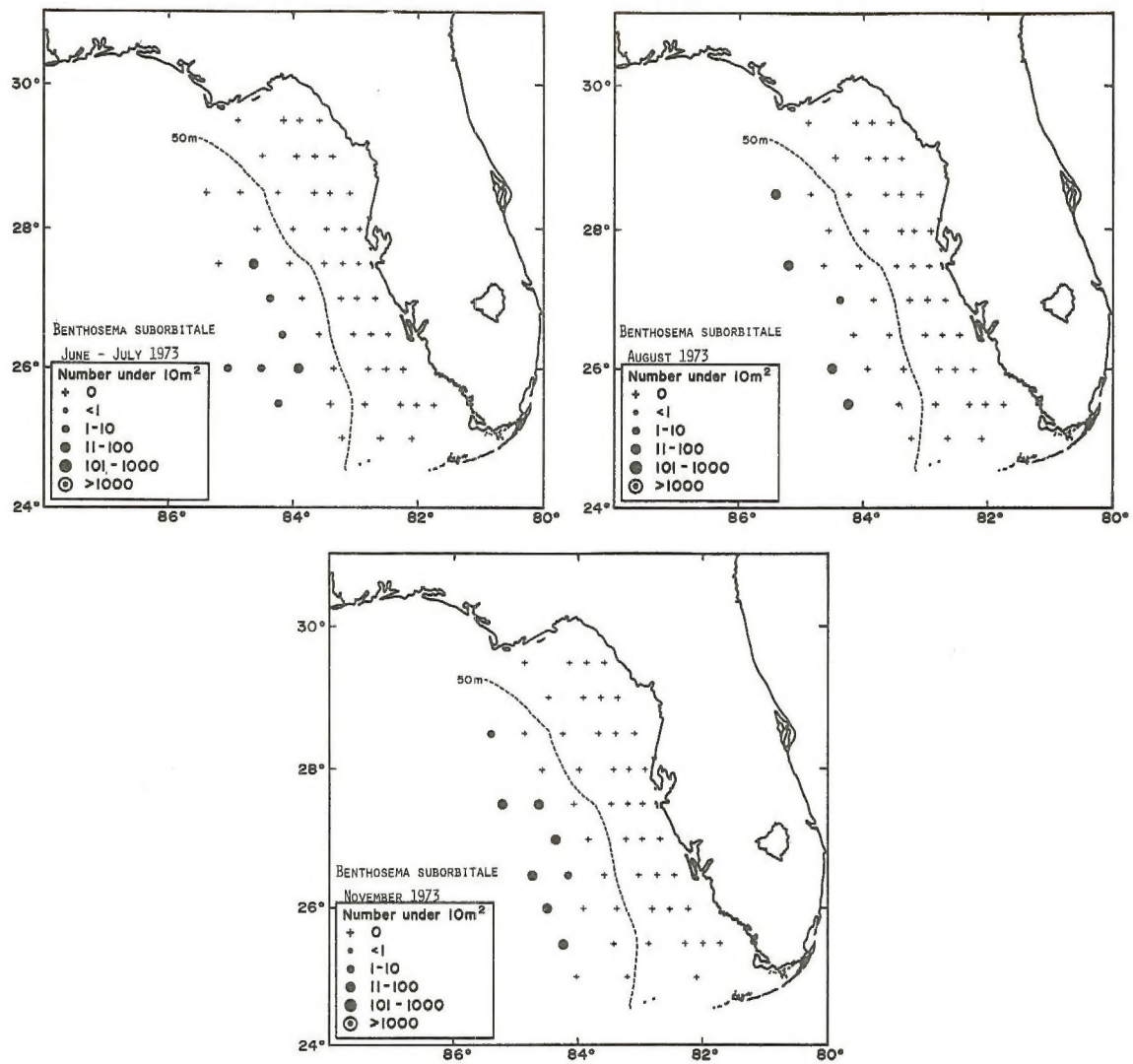


Fig. 46

Cont.

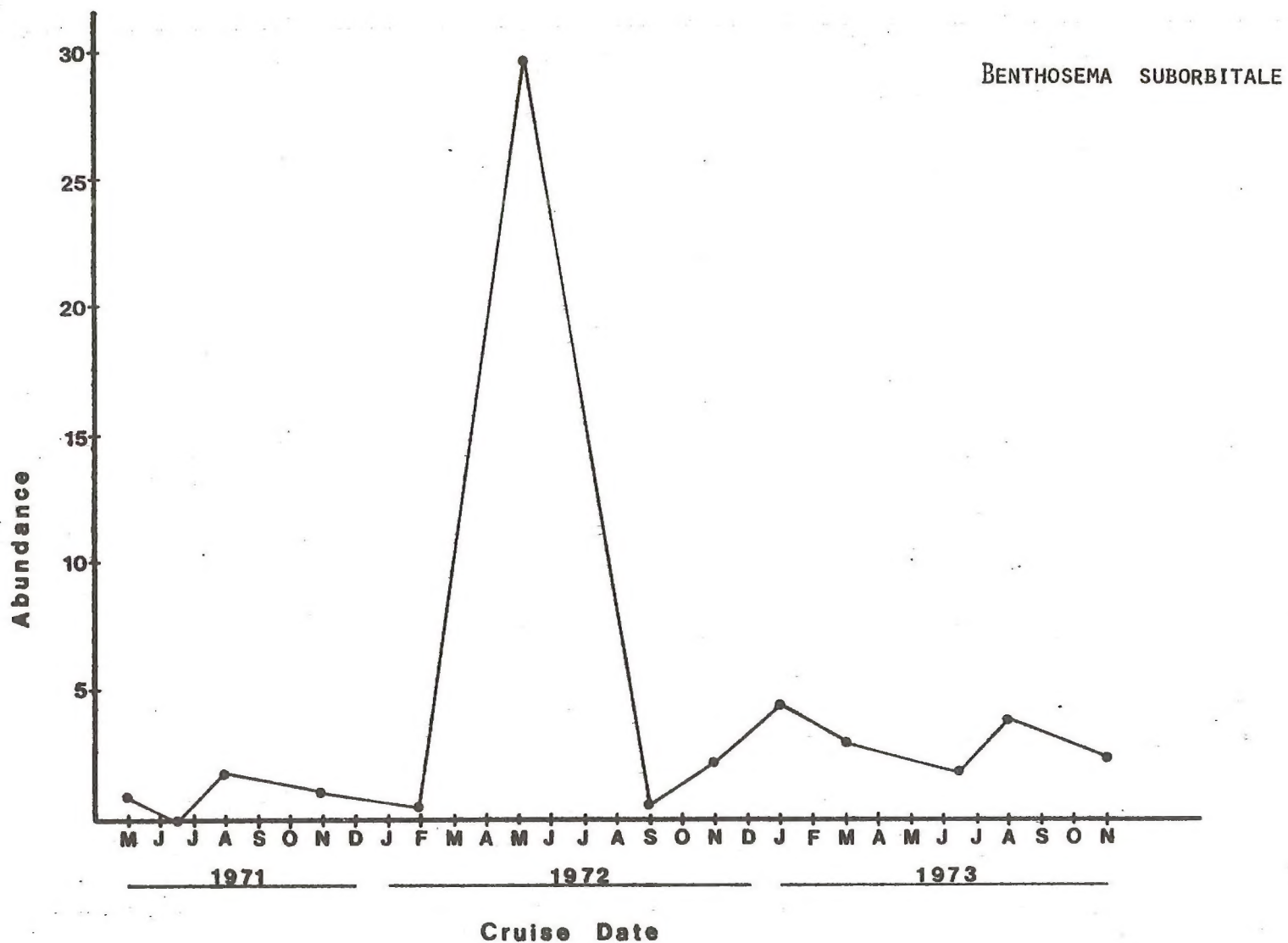


Fig. 47 Estimated mean abundances (number under 10 m² of sea surface) of Benthosema suborbitale larvae in the eastern Gulf of Mexico, 1971-1974.

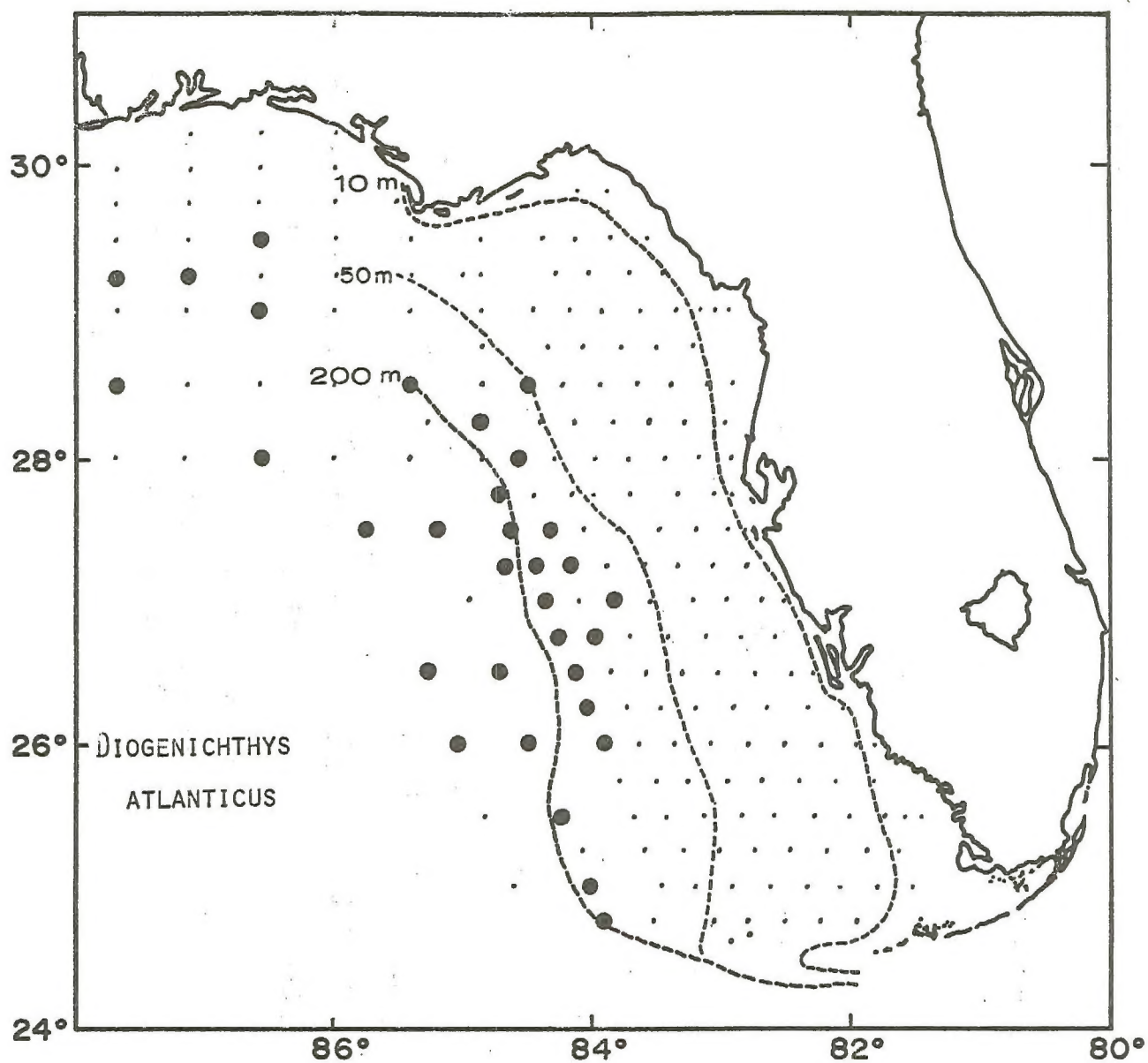


Fig. 48

Stations at which *Diogenichthys atlanticus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

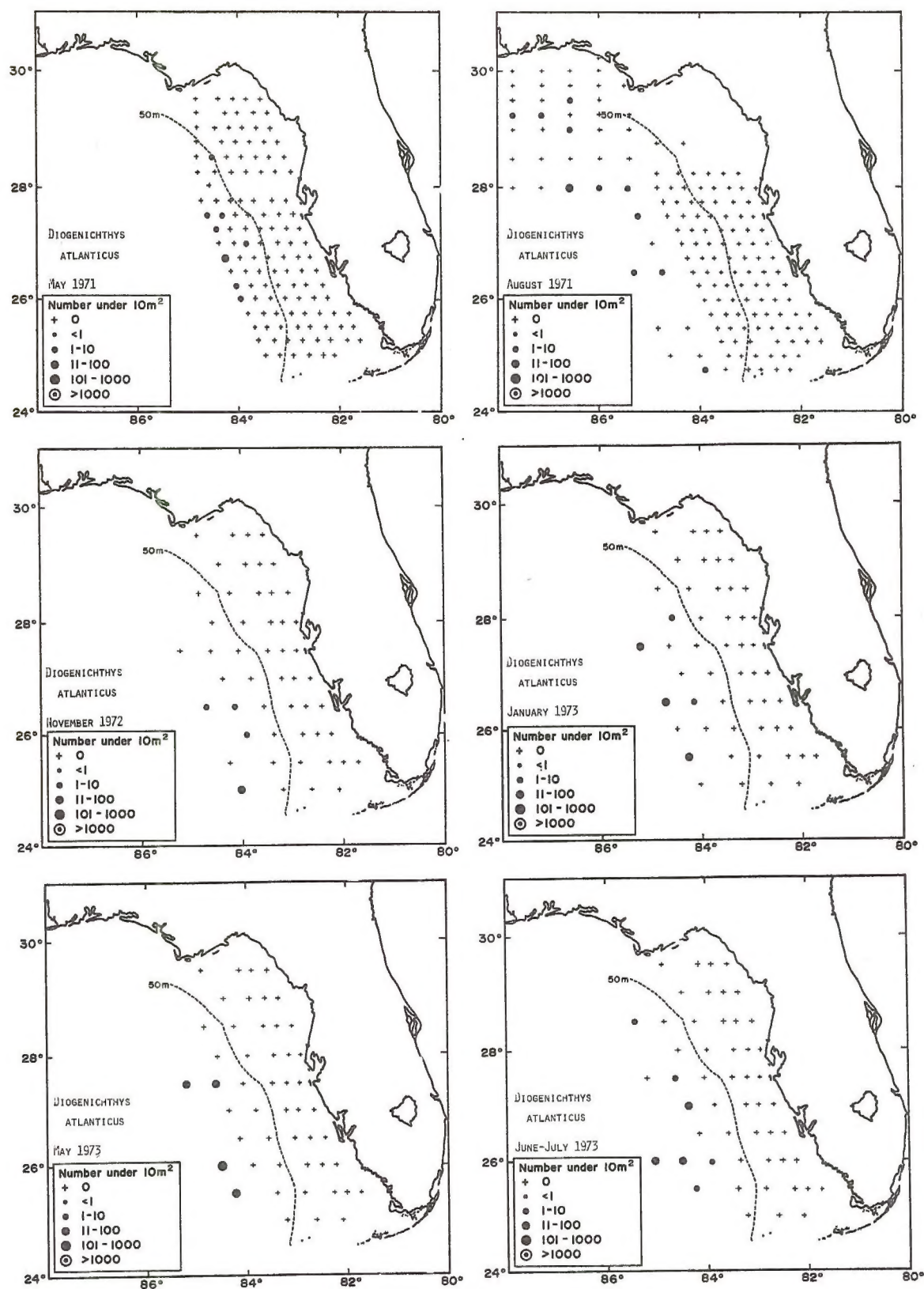


Fig. 49 Distribution and abundance of *Diogenichthys atlanticus* larvae in the eastern Gulf of Mexico, 1971-1974.

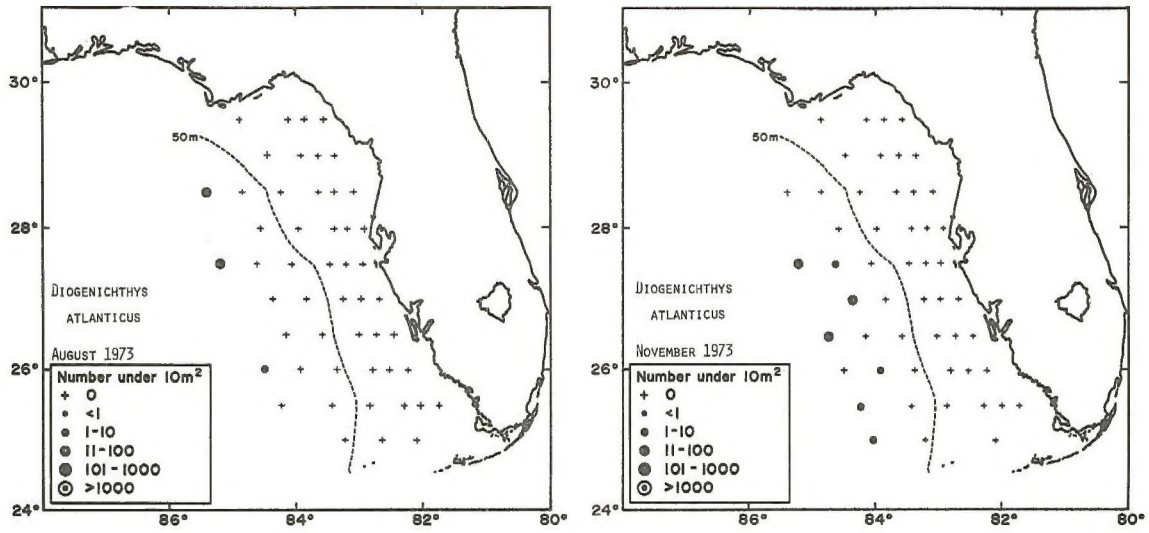


Fig. 49

Cont.

DIOGENICHTHYS ATLANTICUS

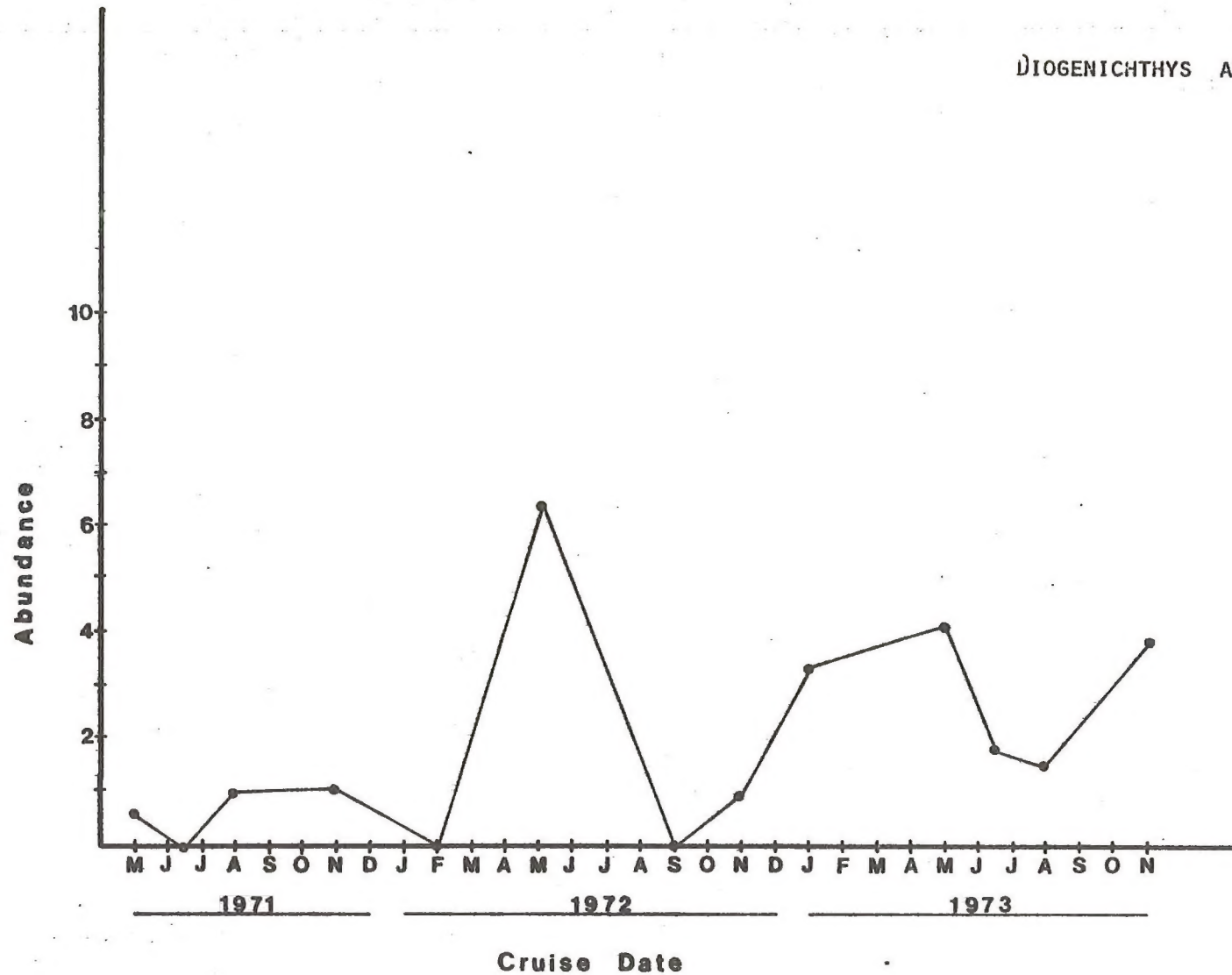


Fig. 50 Estimated mean abundances (number under 10 m² of sea surface) of *Diogenichthys atlanticus* larvae in the eastern Gulf of Mexico, 1971-1974.

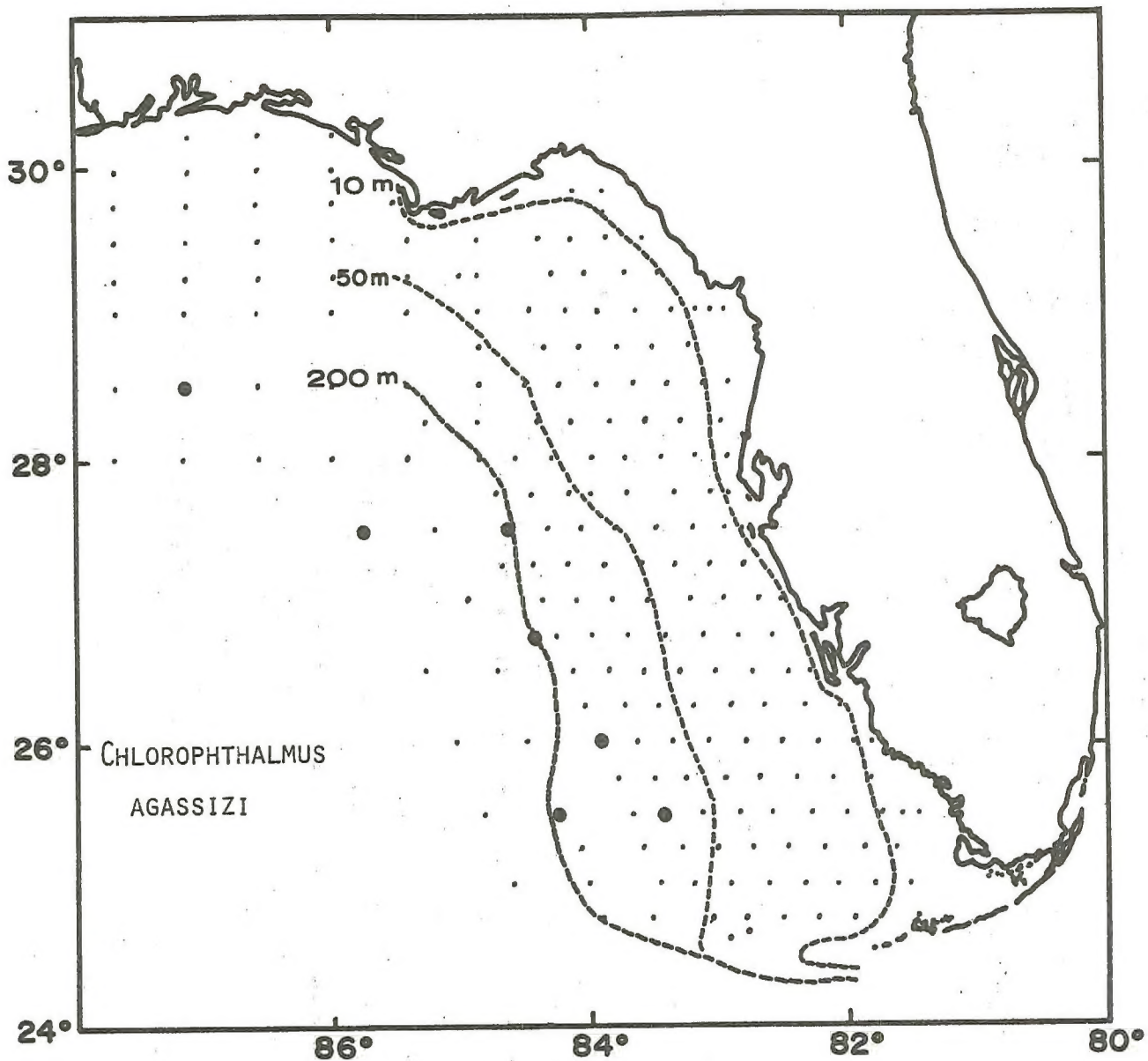


Fig. 51 Stations at which *Chlorophthalmus agassizi* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

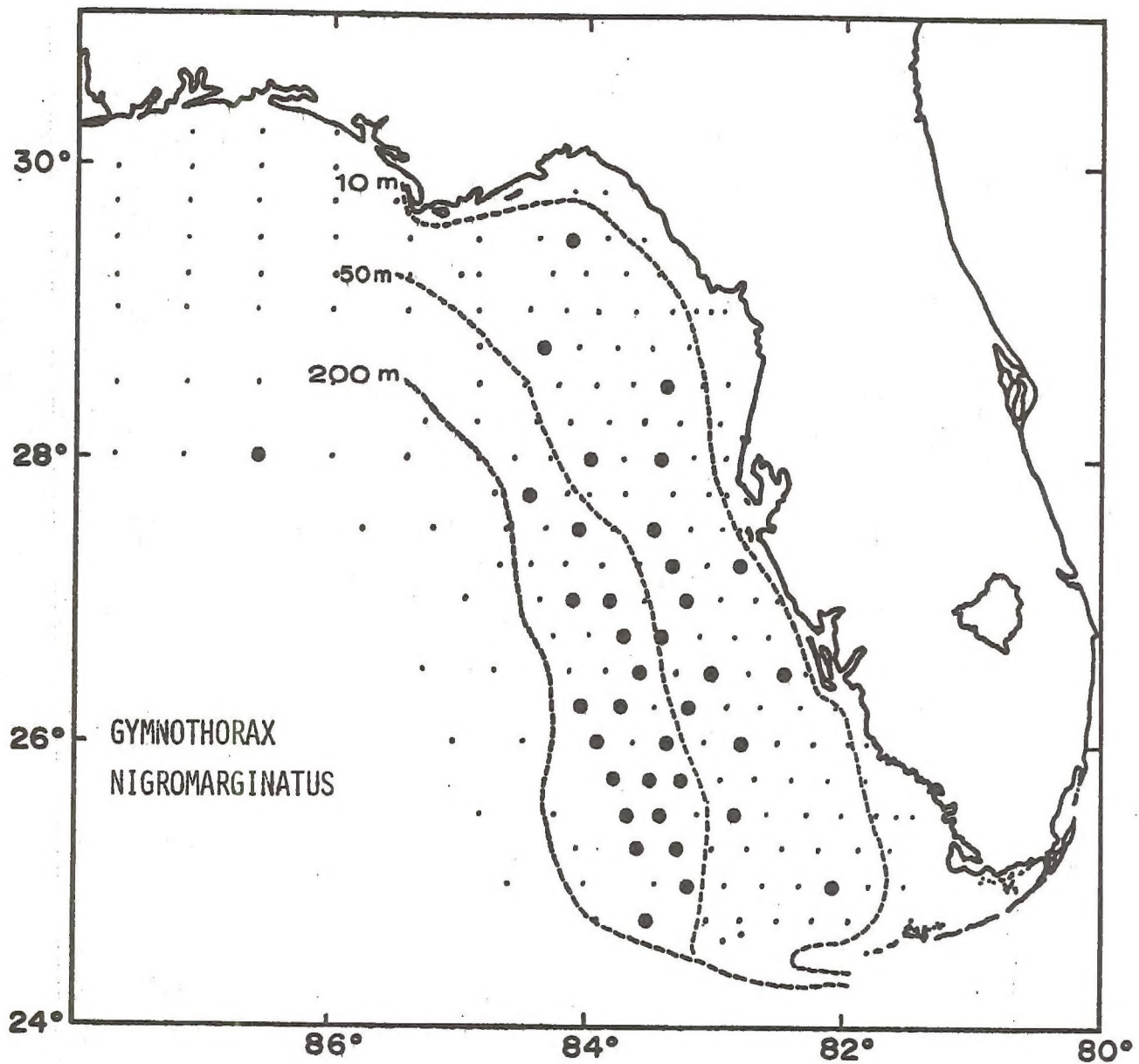


Fig. 52

Stations at which *Gymnothorax nigromarginatus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

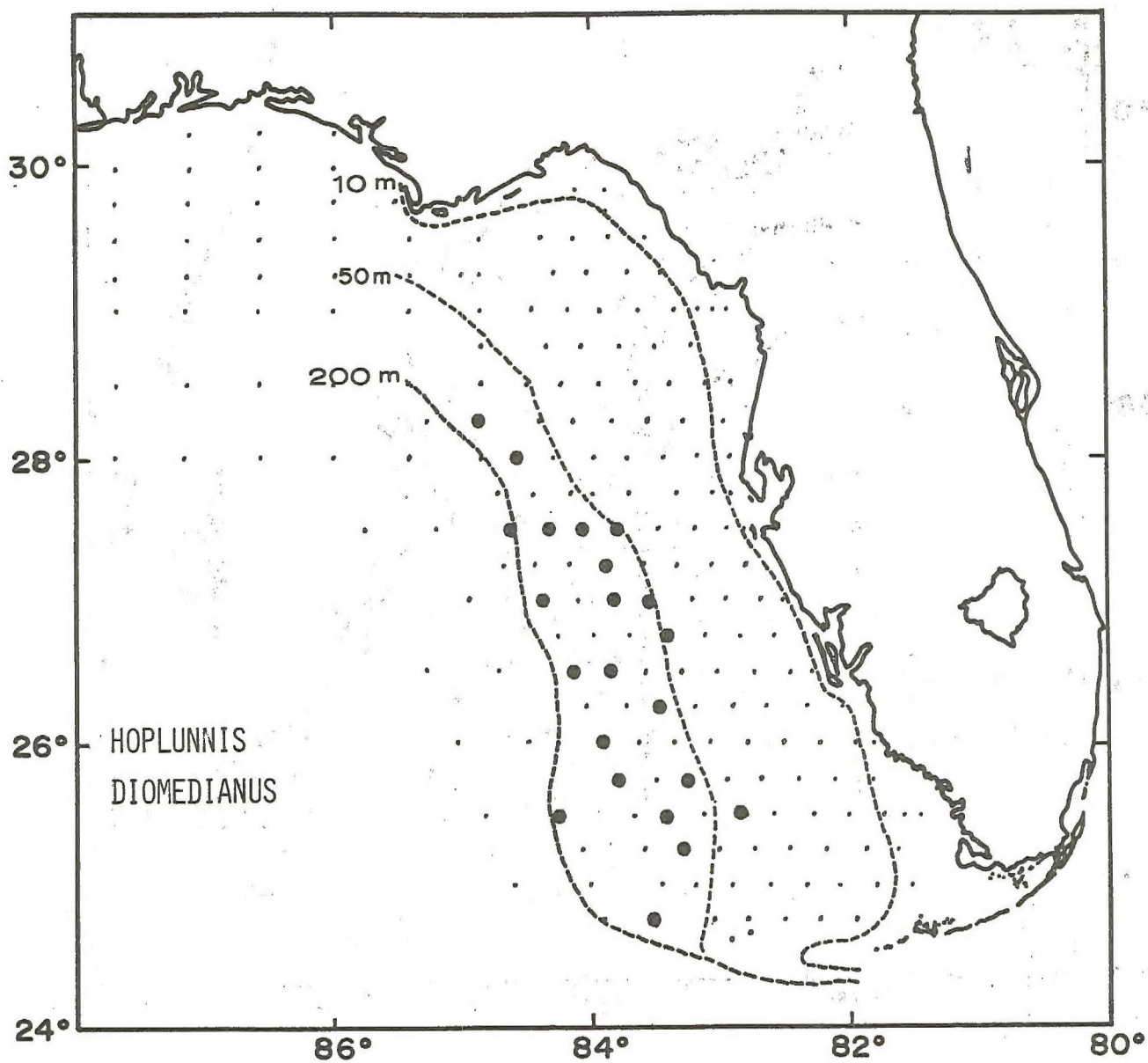


Fig. 53

Stations at which *Hoplunnis diomedianus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

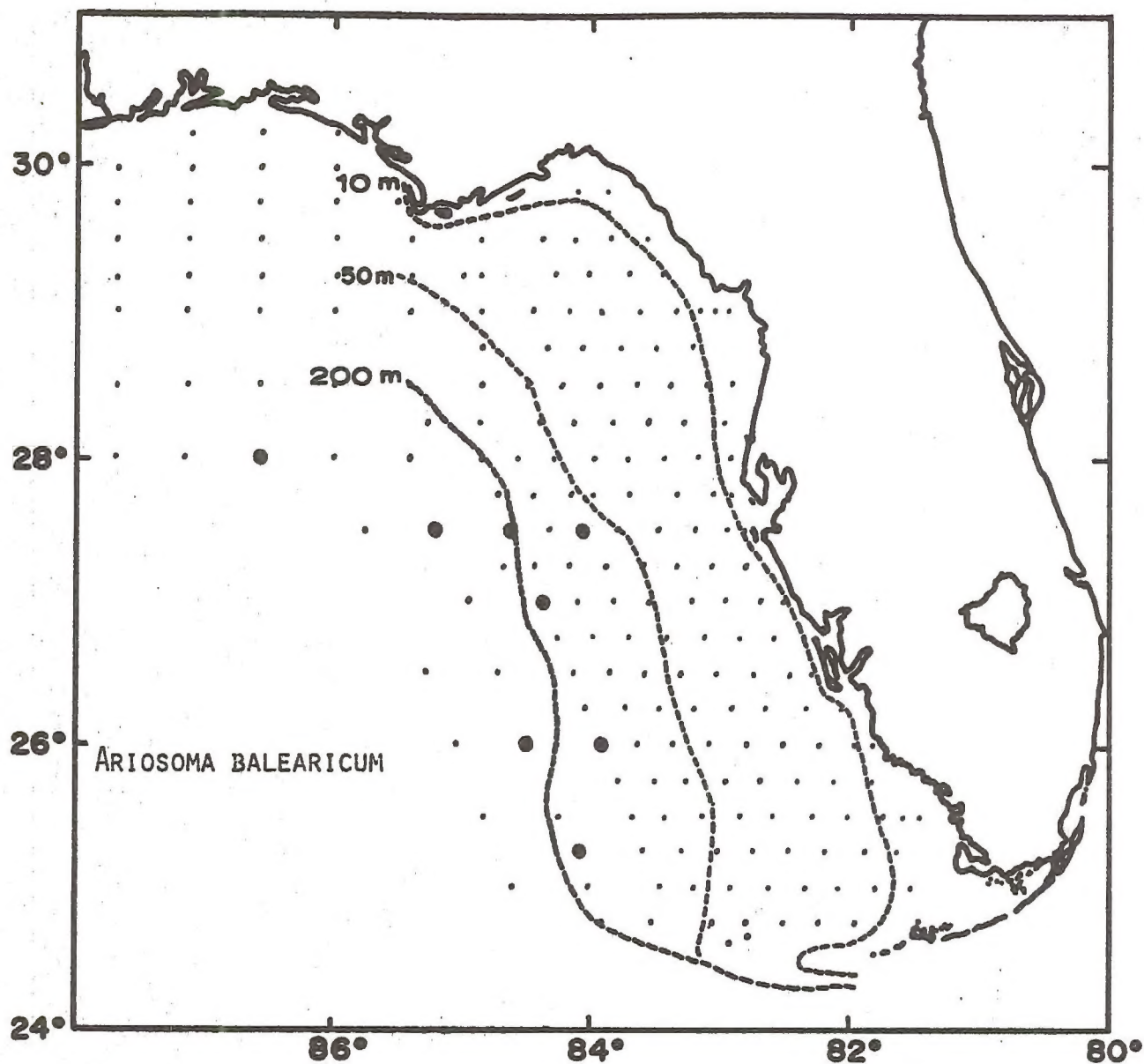


Fig. 54

Stations at which *Ariosoma balearicum* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

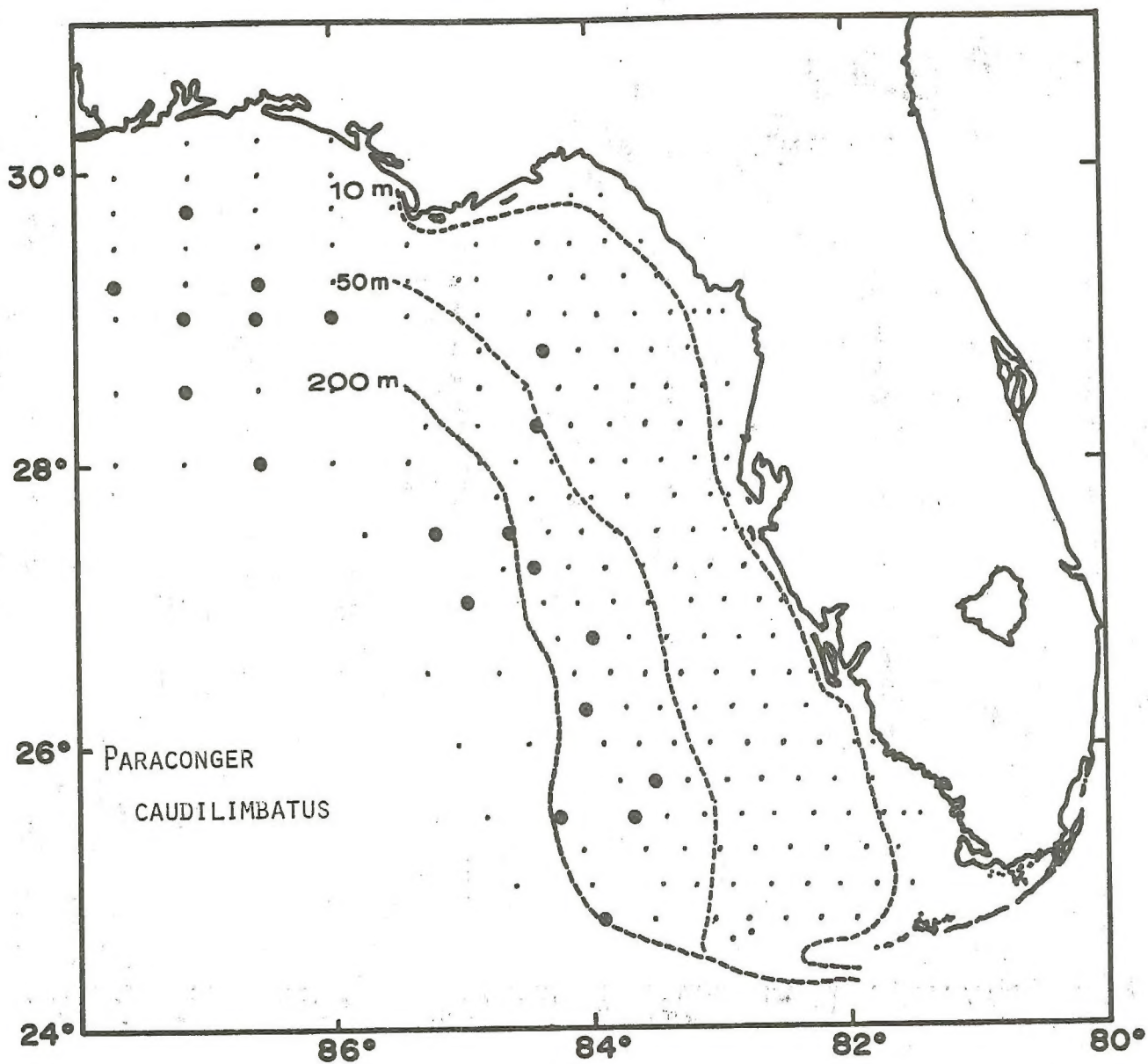


Fig. 55

Stations at which Paraconger caudilimbatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

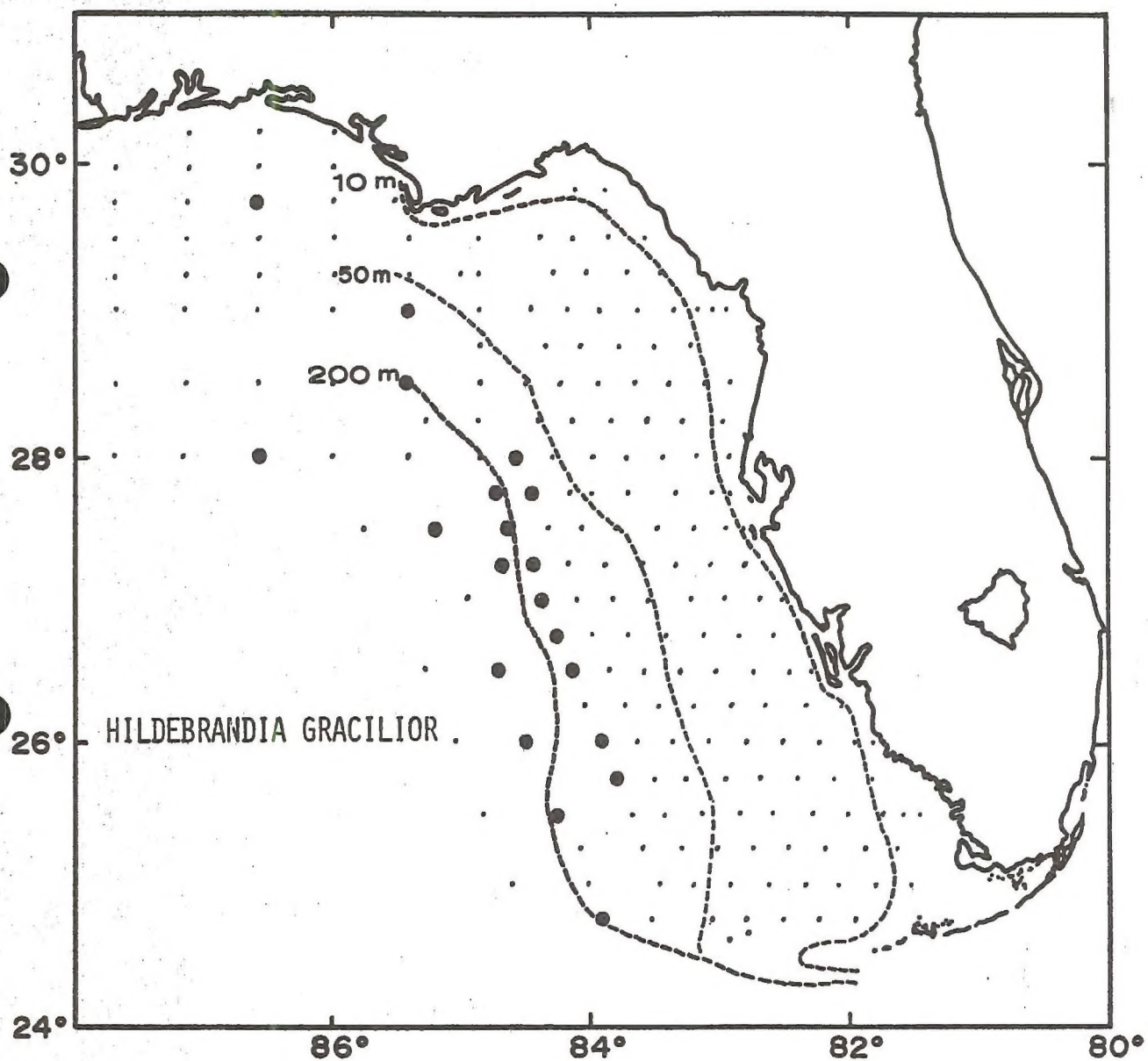


Fig. 56

Stations at which *Hildebrandia gracilior* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

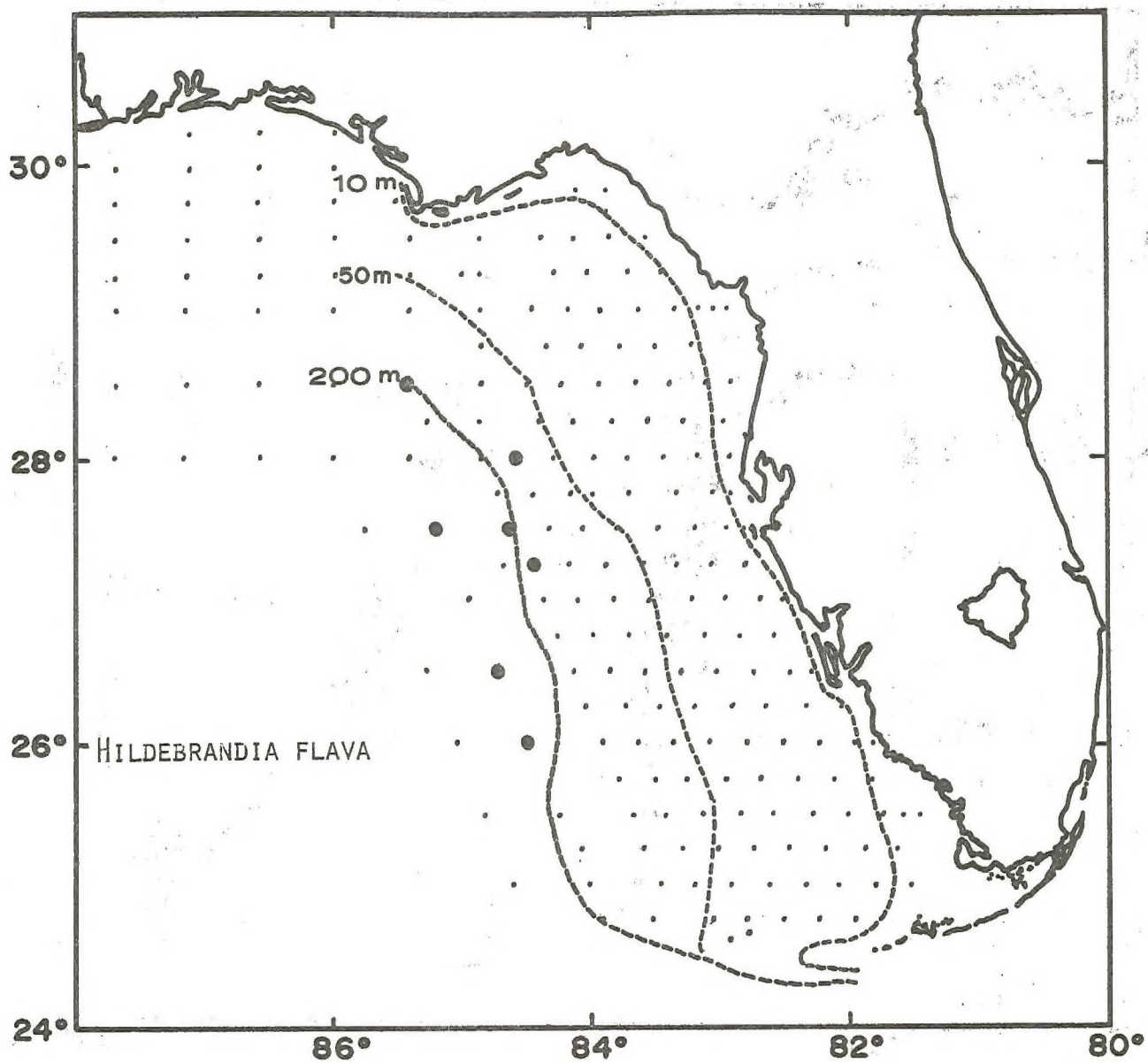


Fig. 57 Stations at which *Hildebrandia flava* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

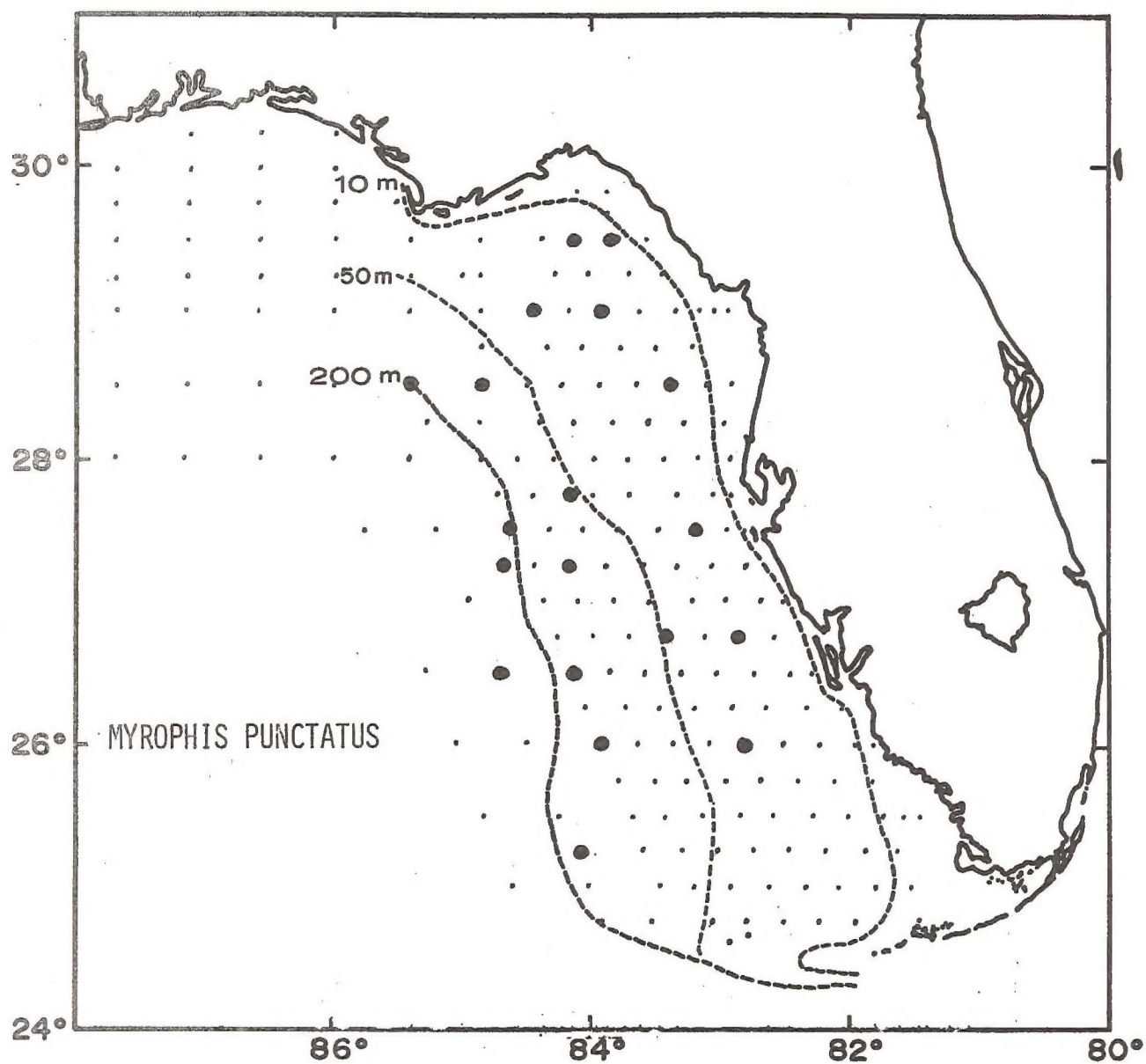


Fig. 58

Stations at which Myrophis punctatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

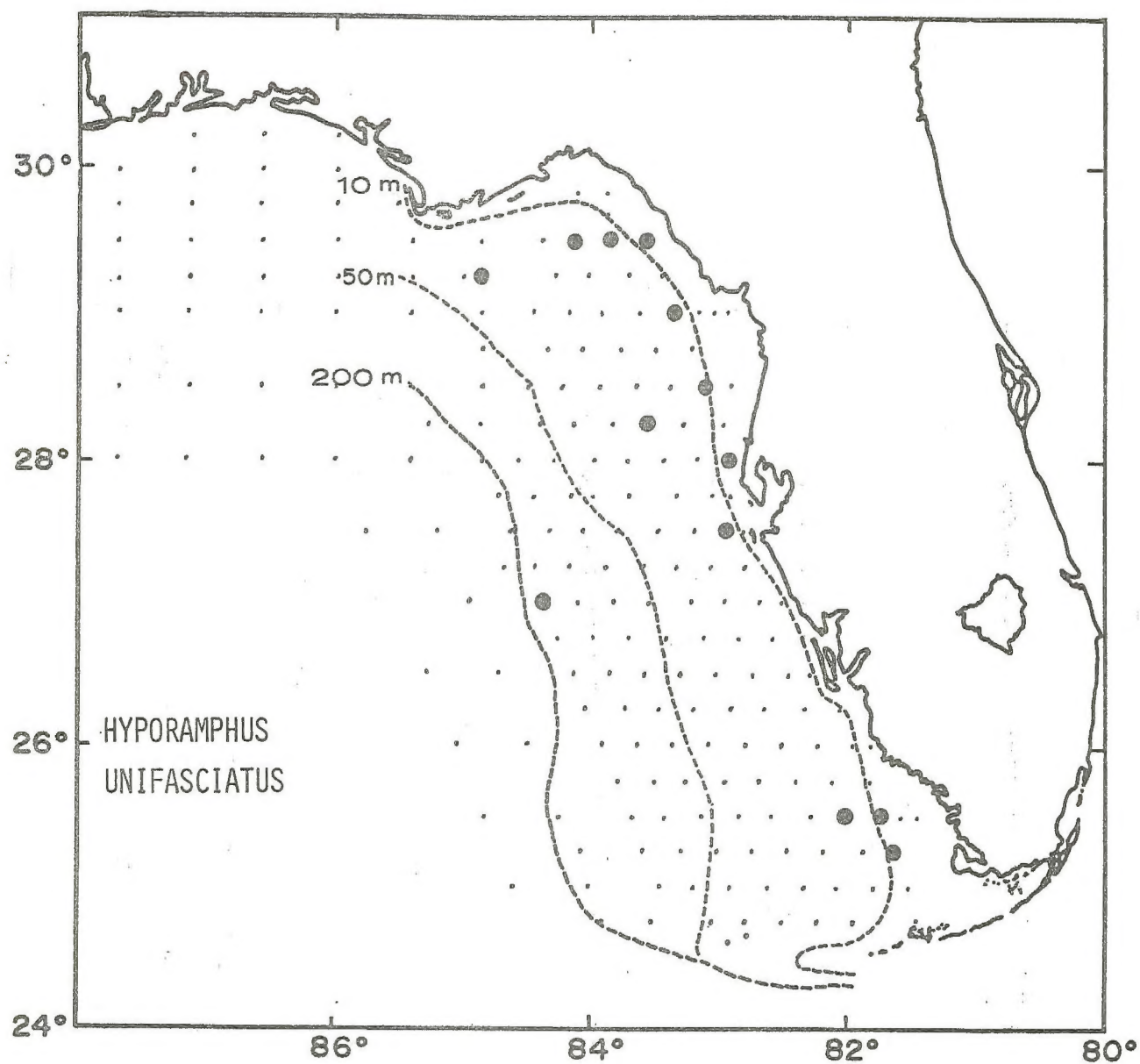


Fig. 59

Stations at which Hyporhamphus unifasciatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

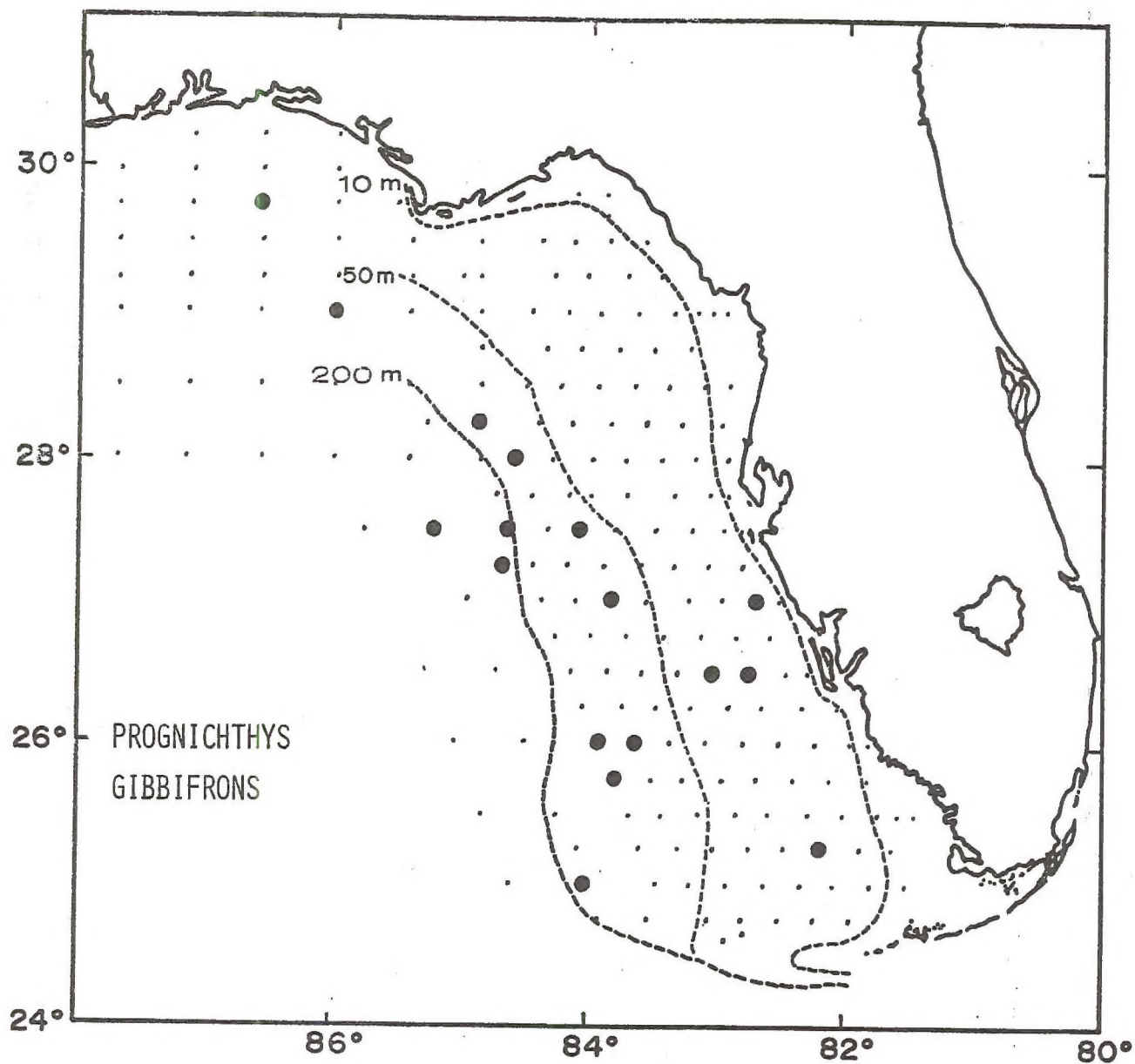


Fig. 60

Stations at which *Prognichthys gibbifrons* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

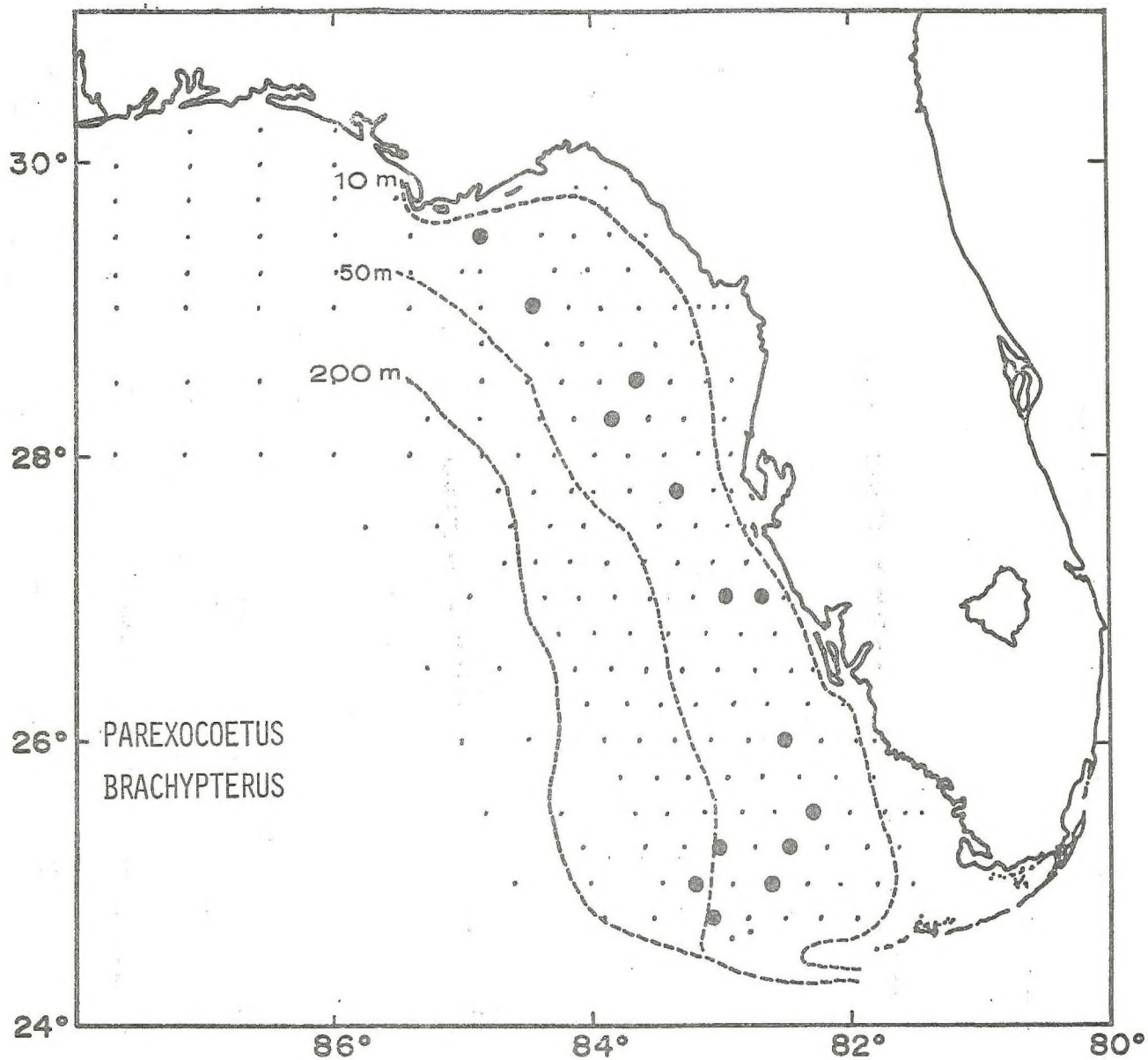


Fig. 61

Stations at which *Parexocoetus brachypterus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

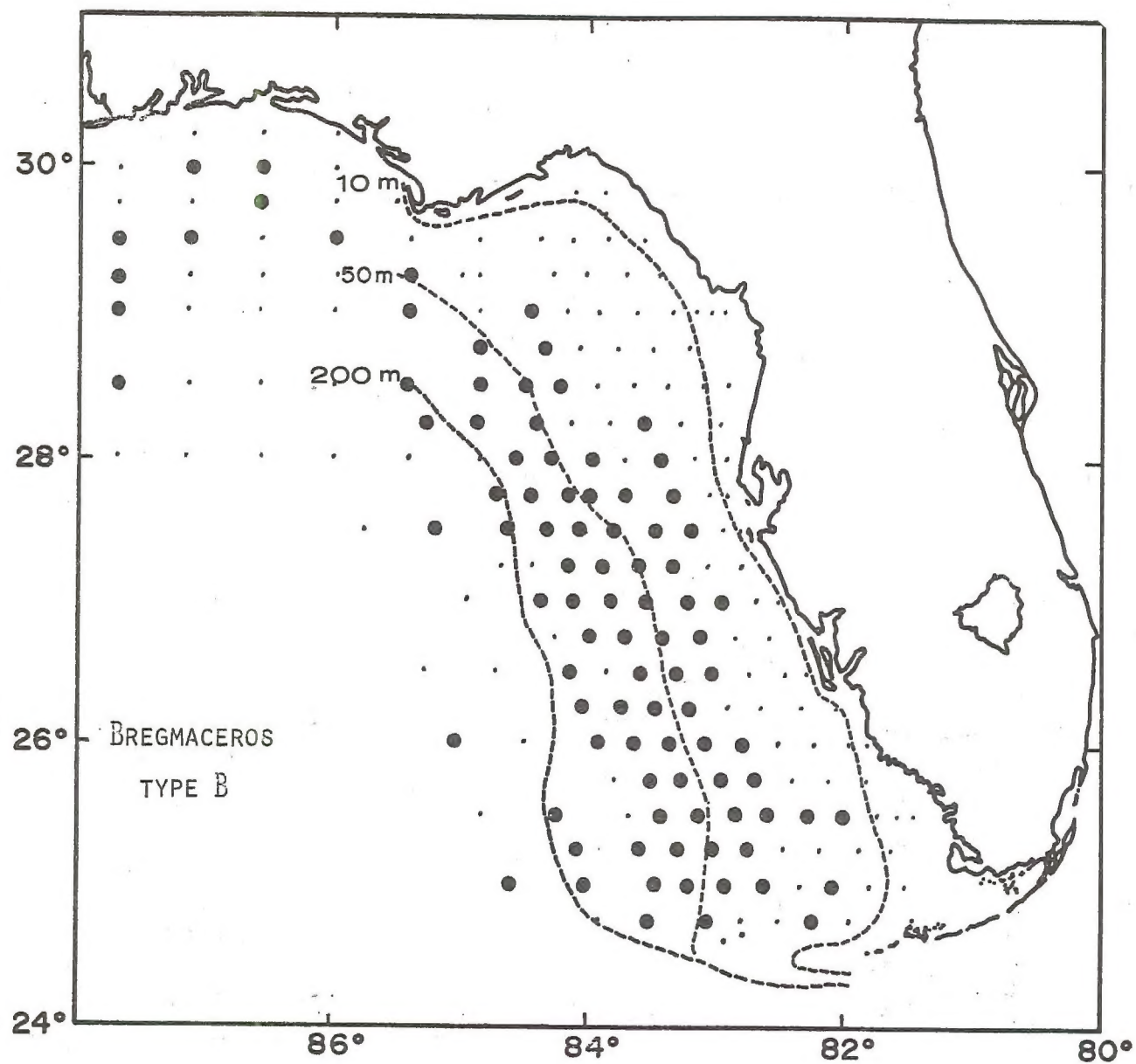


Fig. 62

Stations at which *Bregmaceros* Type B larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

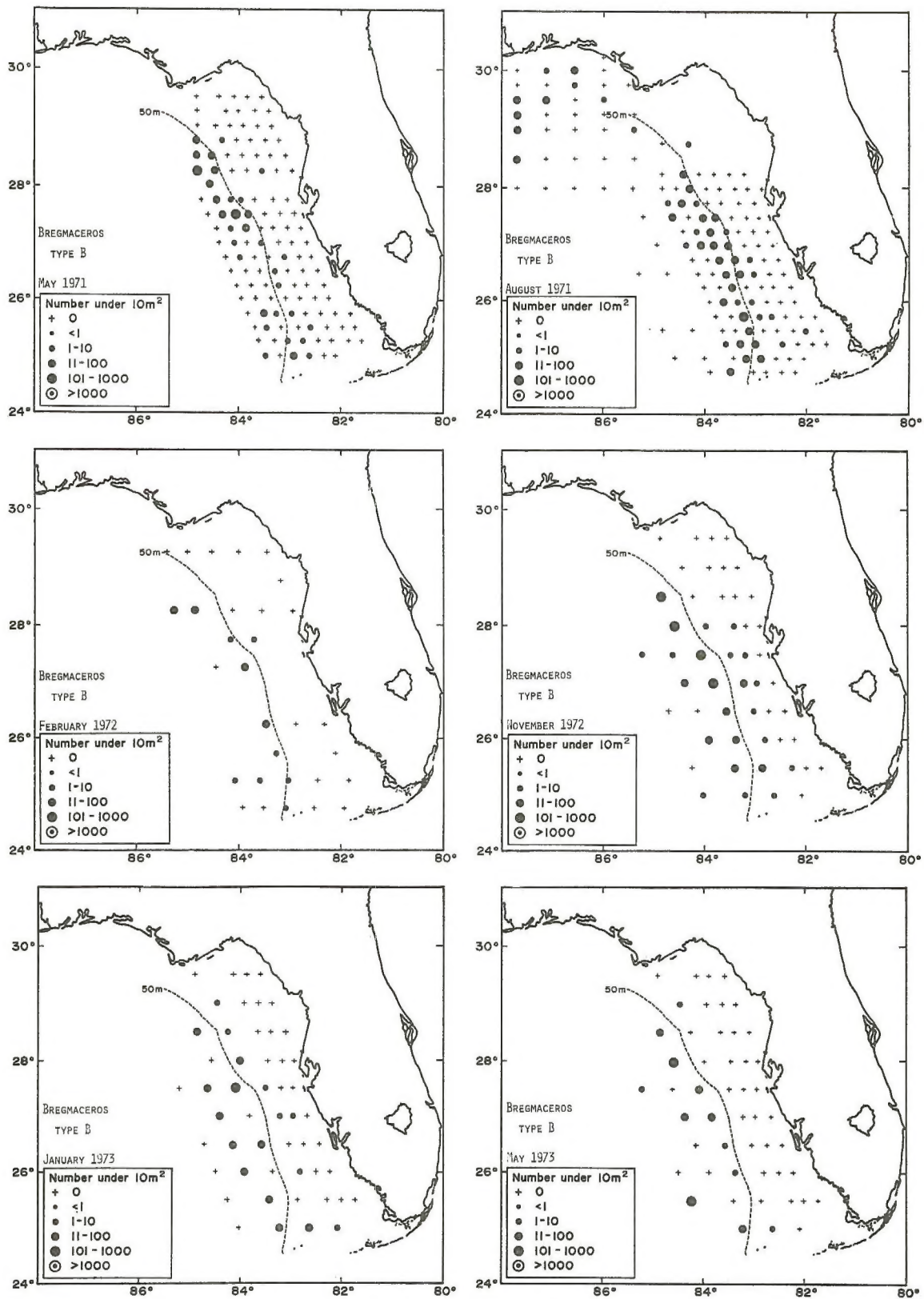


Fig. 63 Distribution and abundance of *Bregmaceros* Type B larvae in the eastern Gulf of Mexico, 1971-1974.

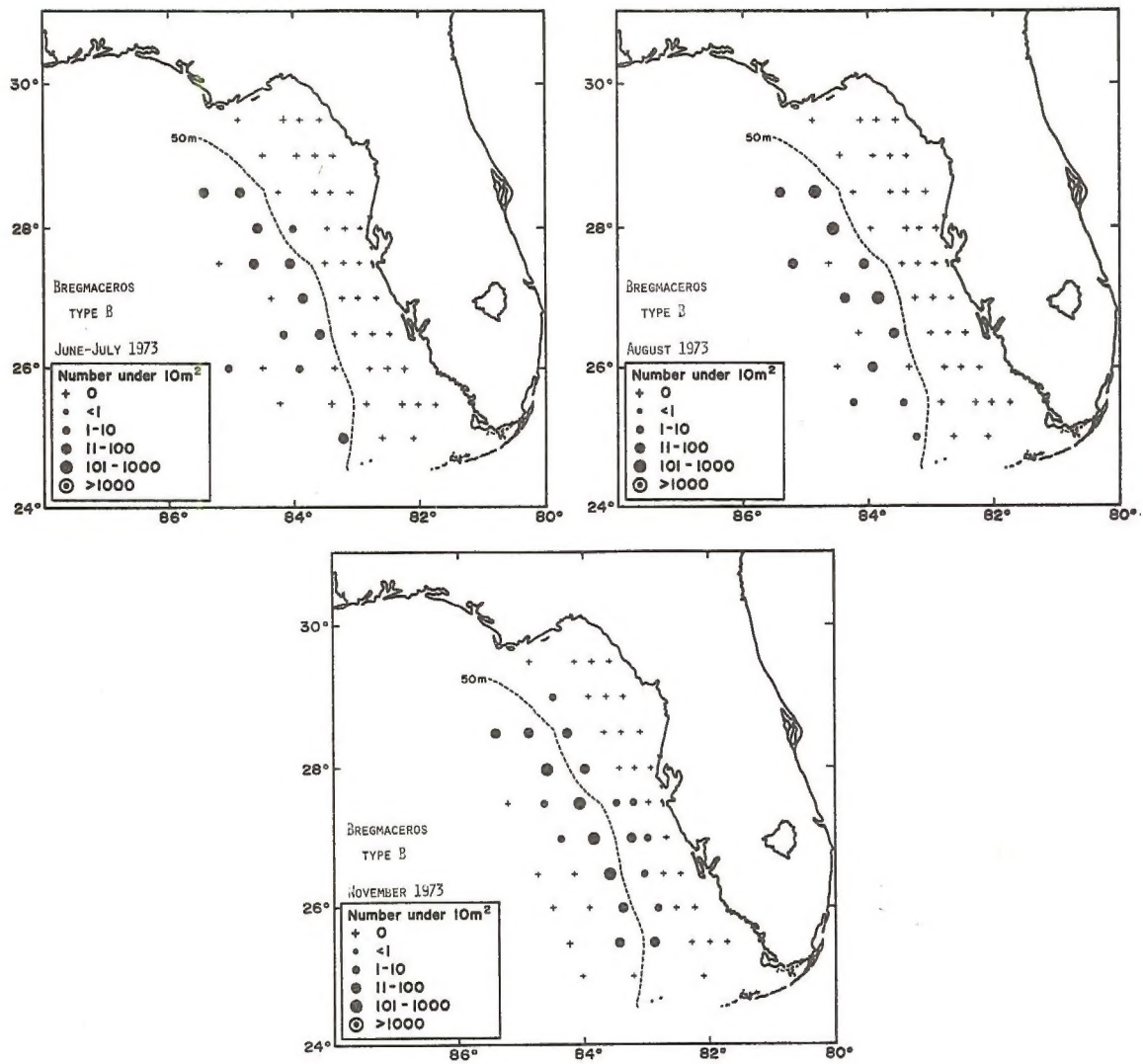


Fig. 63

Cont.

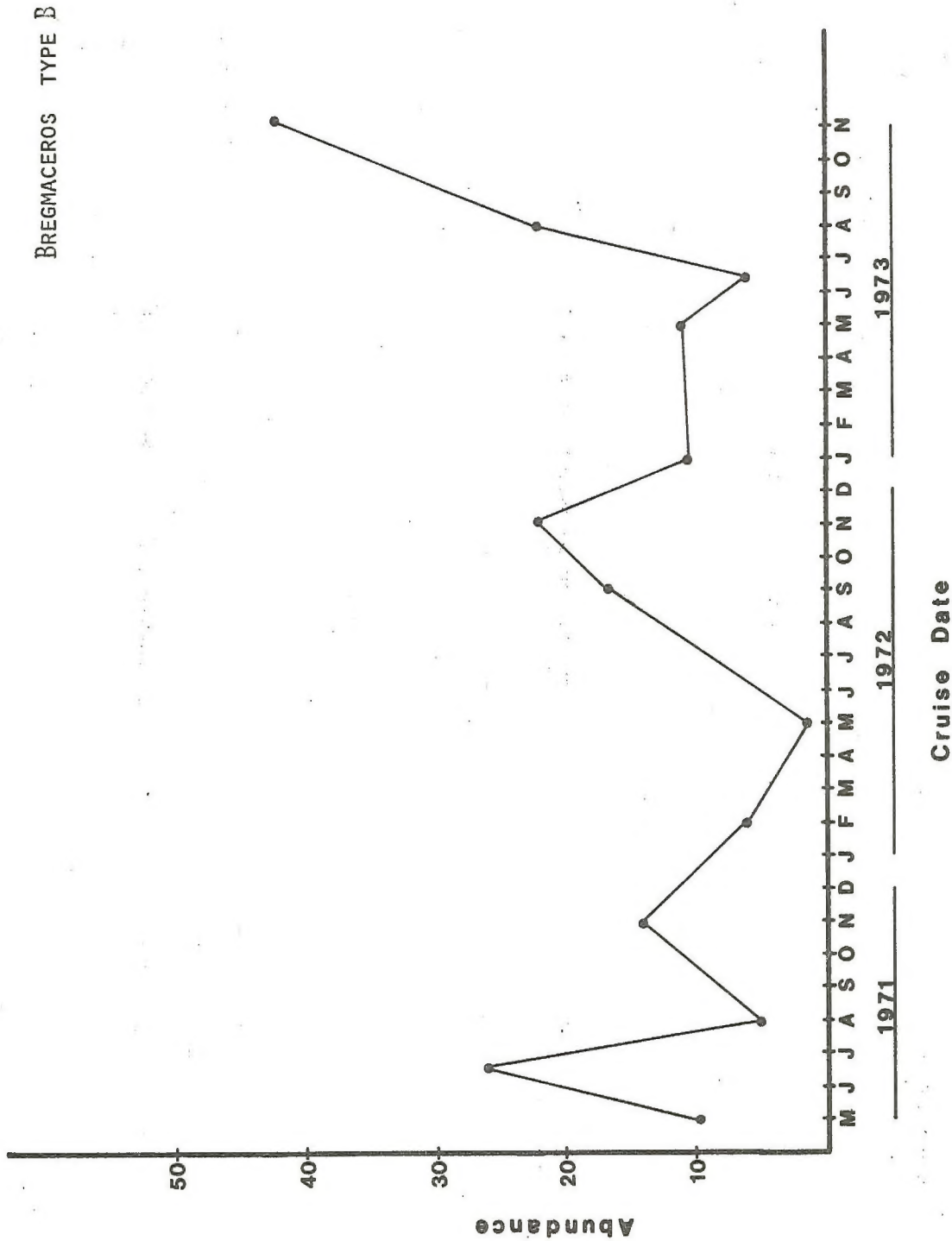


Fig. 64 Estimated mean abundances (number under 10 m² of sea surface) of Bregmaceros Type B larvae in the eastern Gulf of Mexico, 1971-1974.

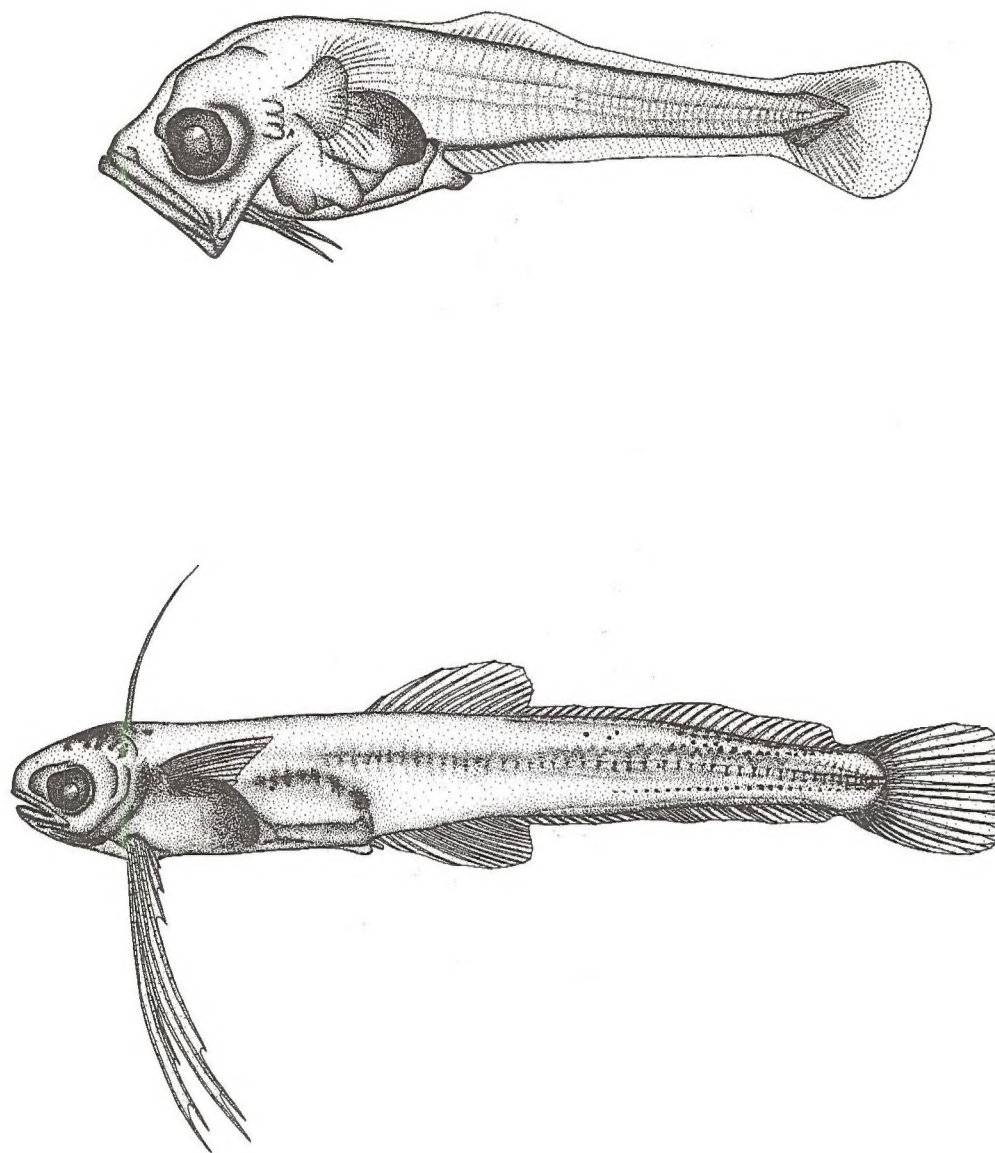


Fig. 65 Larvae of Bregmaceros Type B. The top specimen is a 4.0 mm SL larva. The bottom specimen is a 13.5 mm SL larva.

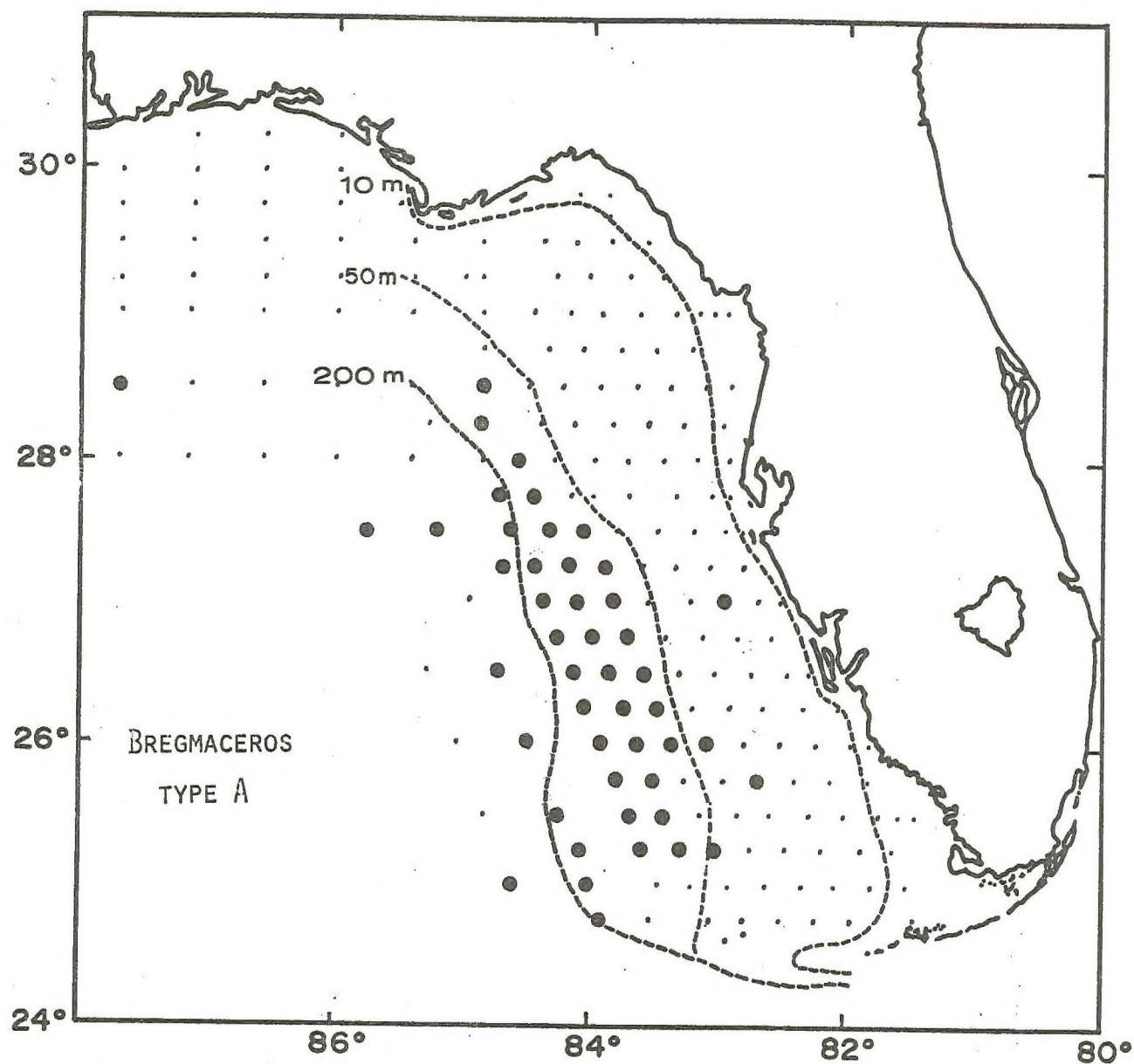


Fig. 66

Stations at which *Bregmaceros* Type A larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

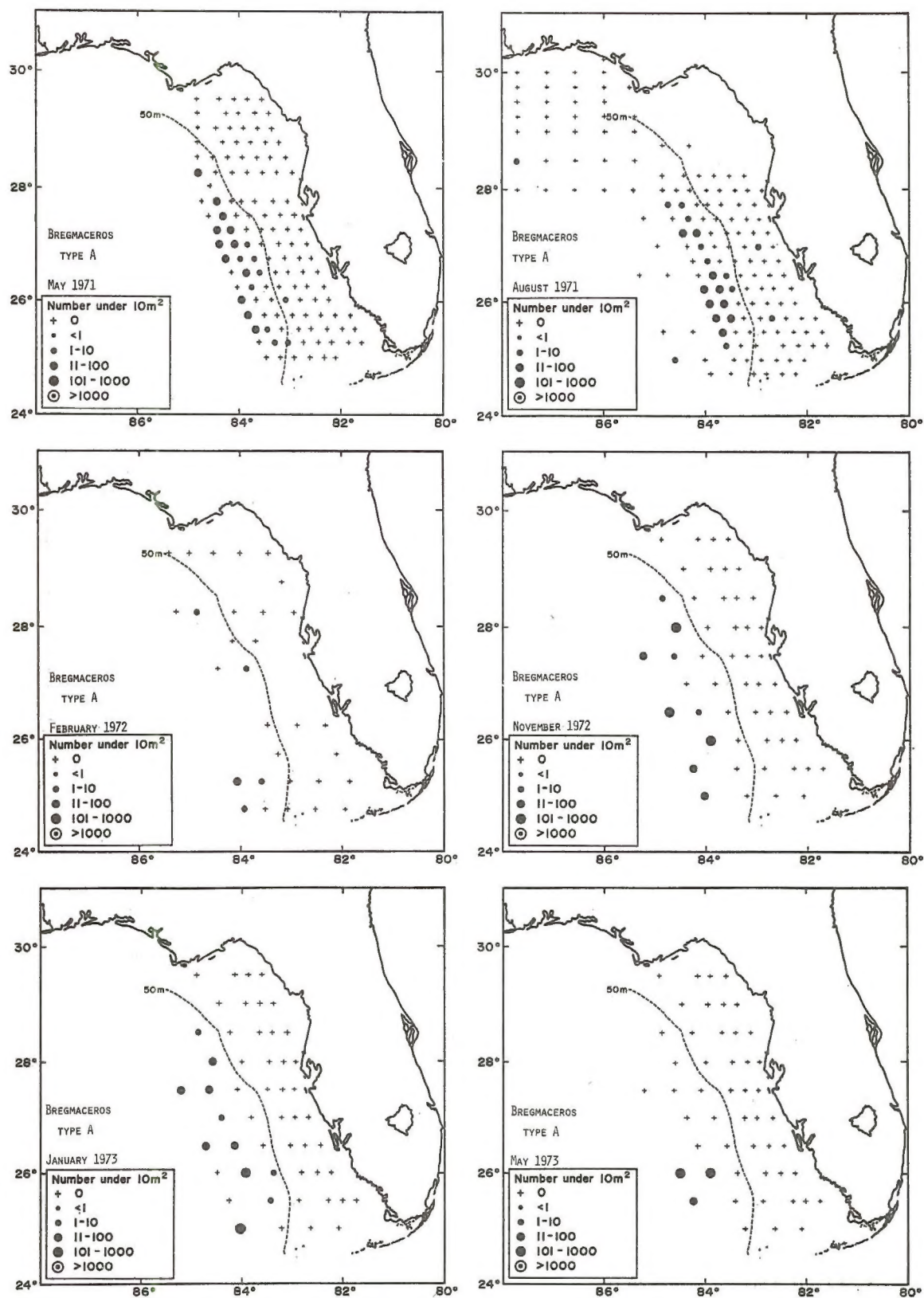


Fig. 67 Distribution and abundance of *Bregmaceros* Type A larvae in the eastern Gulf of Mexico, 1971-1974.

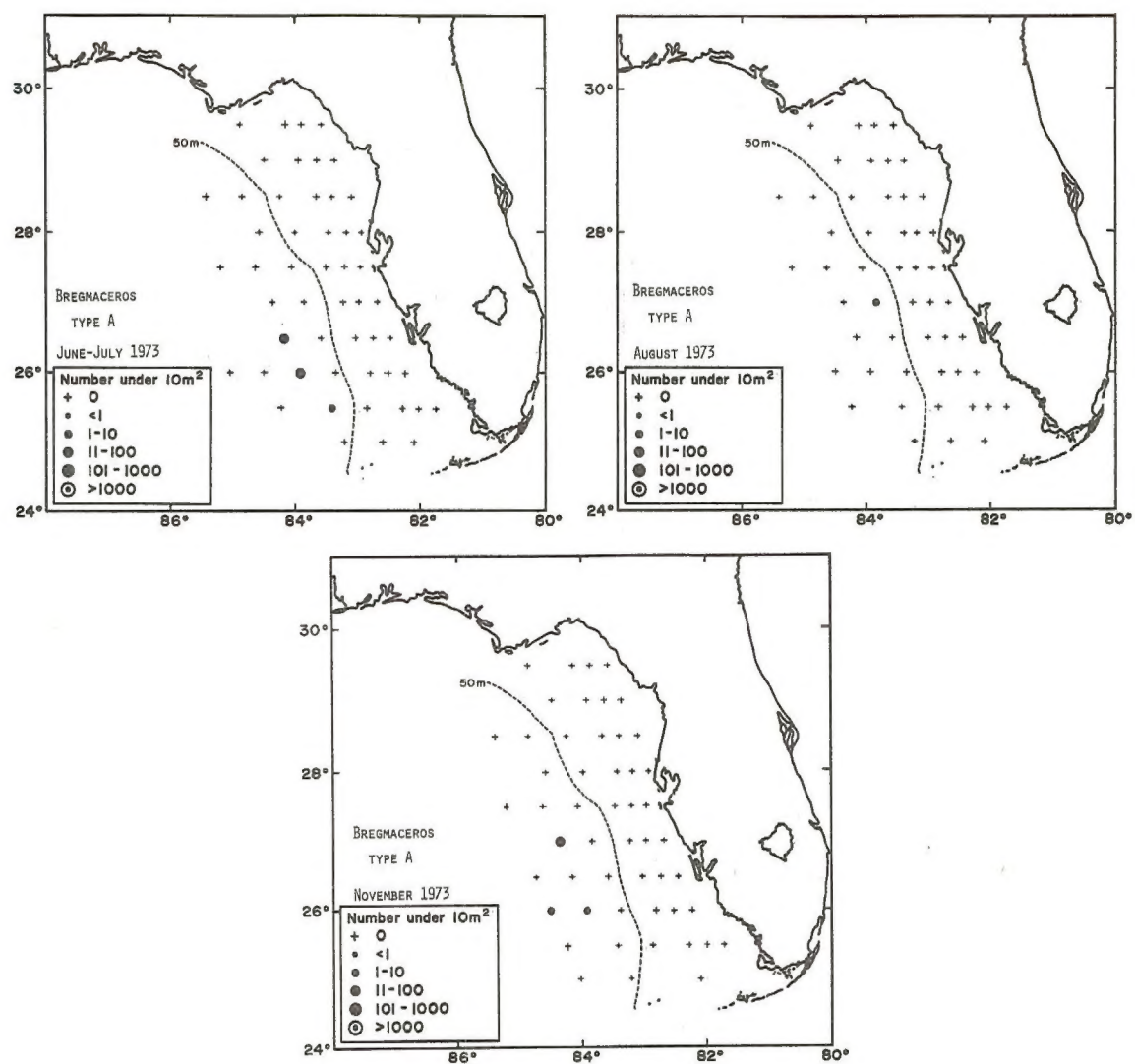


Fig. 67

Cont.

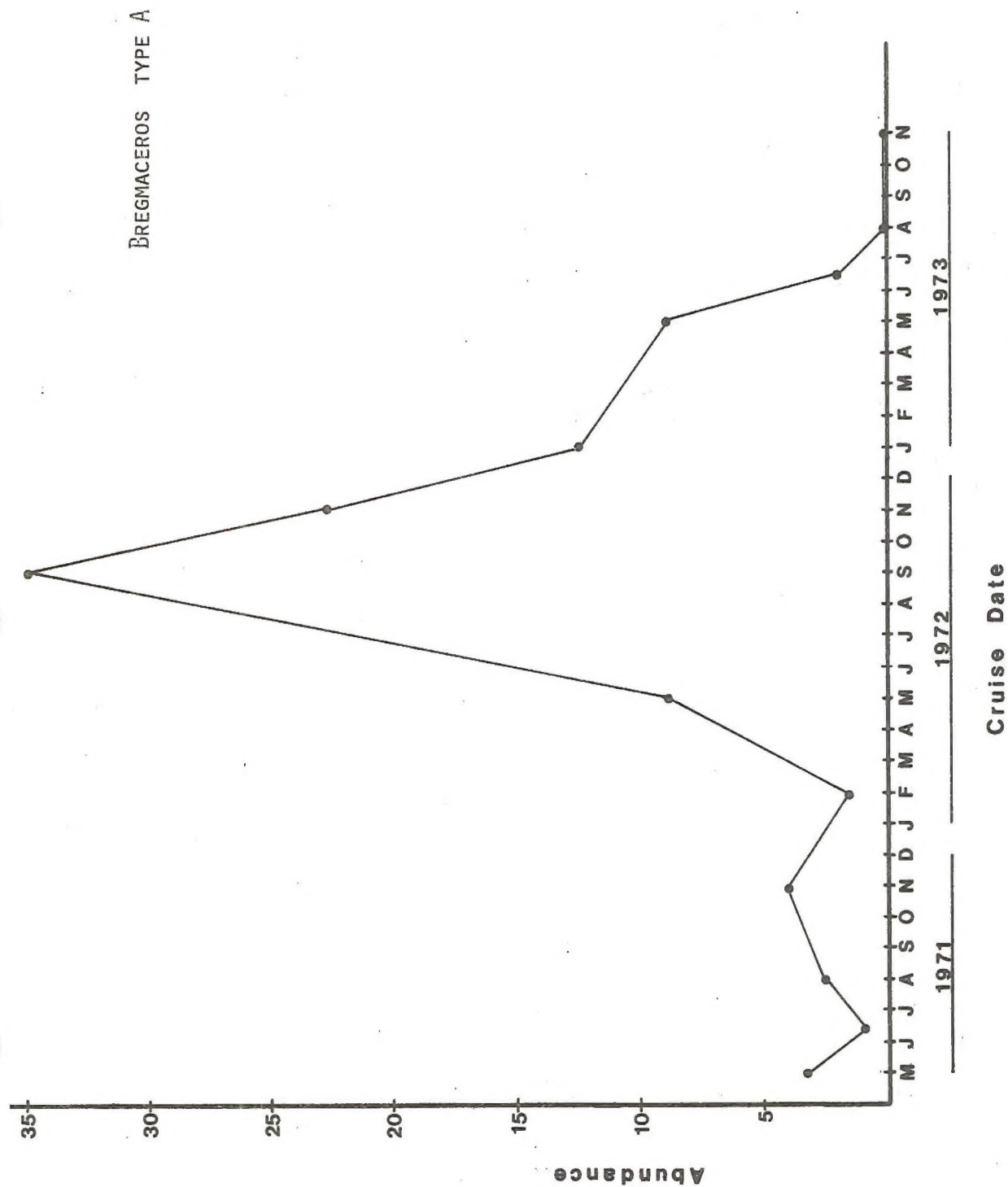


Fig. 68 Estimated mean abundances (number under 10 m² of sea surface) of Bregmaceros Type A larvae in the eastern Gulf of Mexico, 1971-1974.

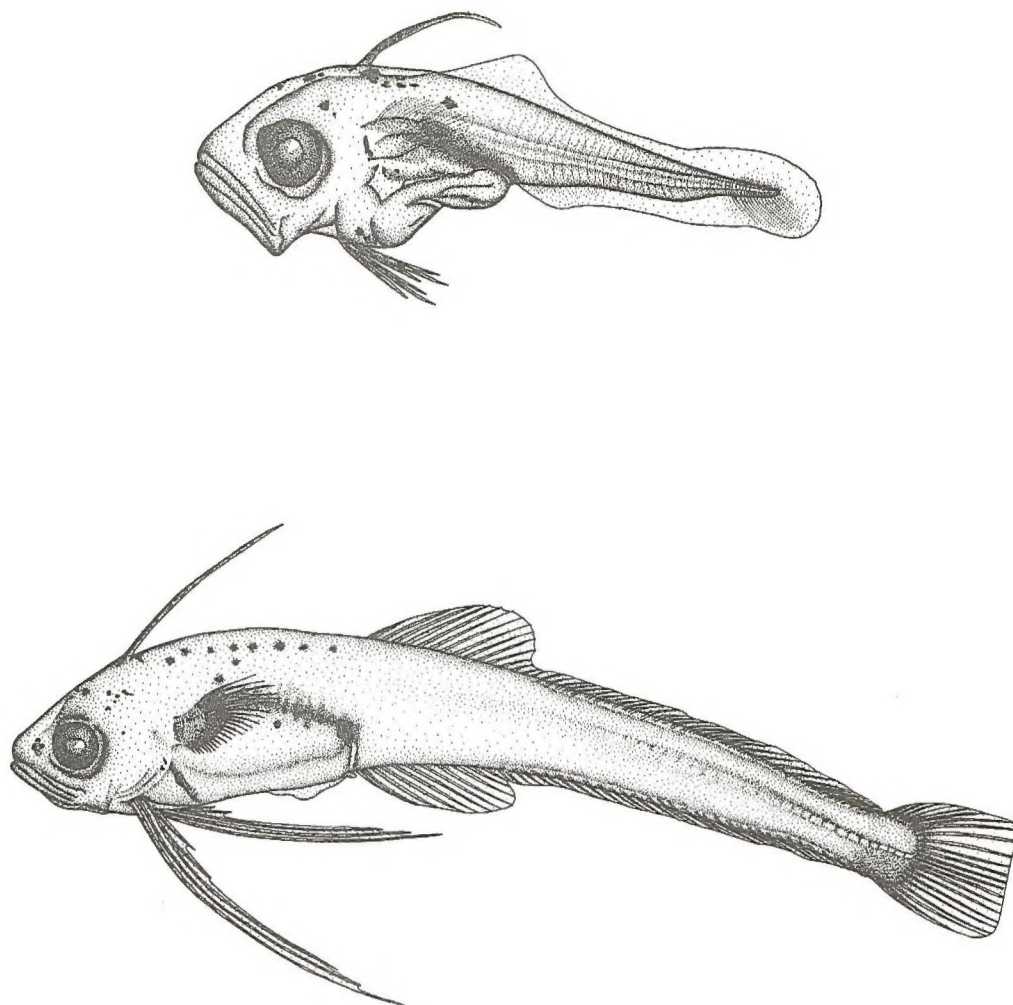


Fig. 69 Larvae of Bregmaceros Type A. The top specimen is a 3.0 mm SL larva. The bottom specimen is a 12.5 mm SL larva.

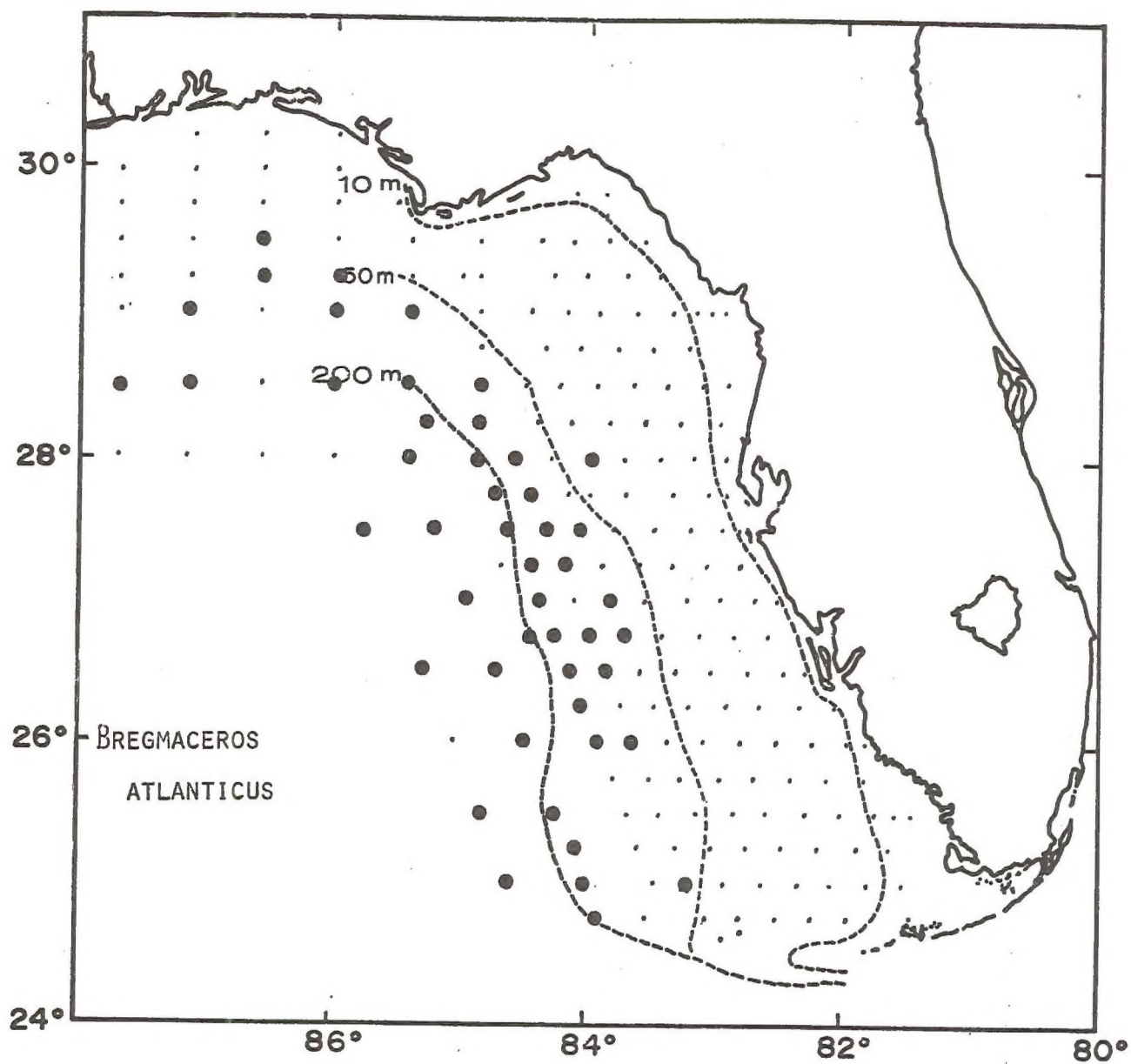


Fig. 70

Stations at which *Bregmaceros atlanticus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

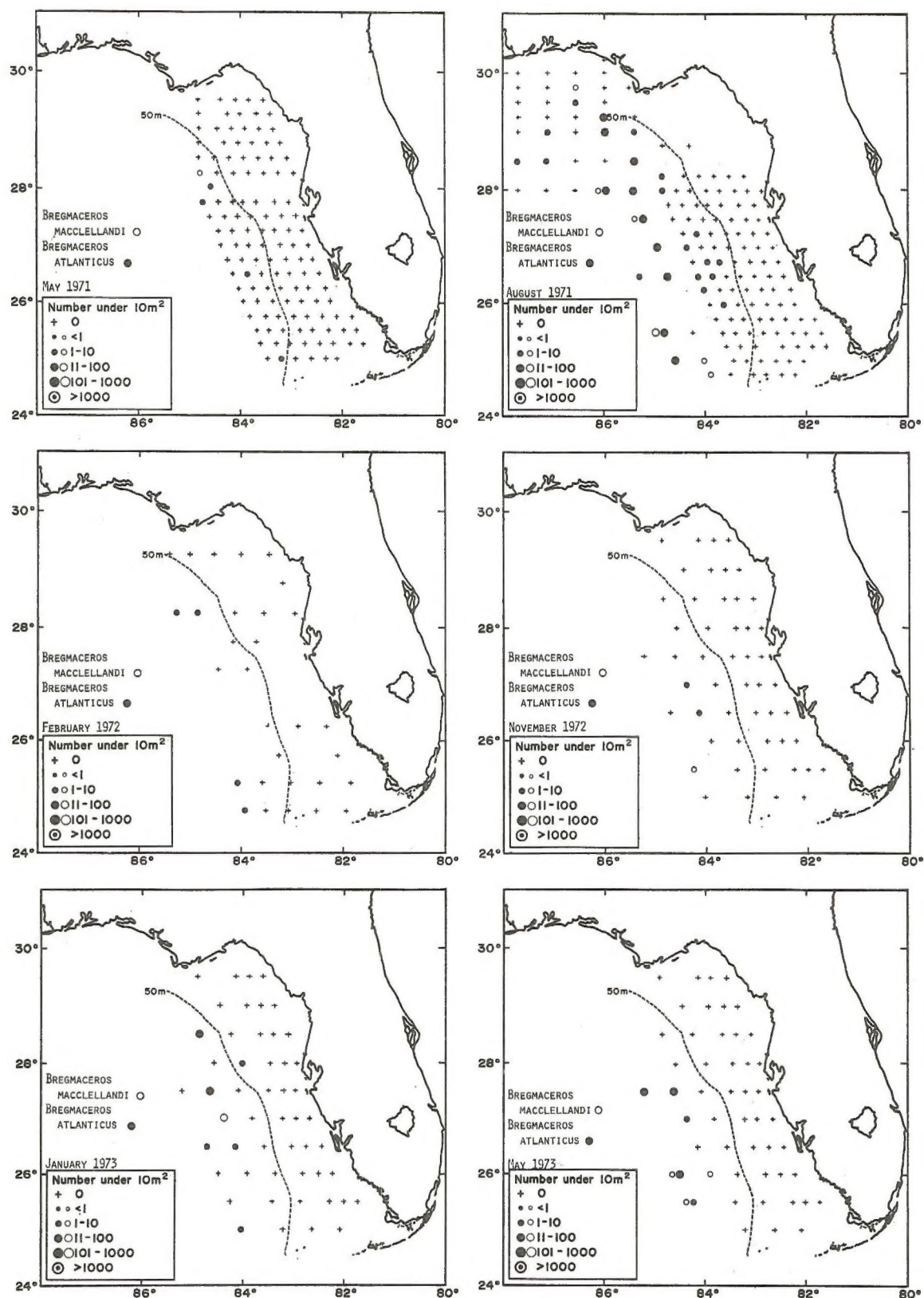


Fig. 71

Distribution and abundance of *Bregmaceros atlanticus* and *Bregmaceros maclellandi* larvae in the eastern Gulf of Mexico, 1971-1974.

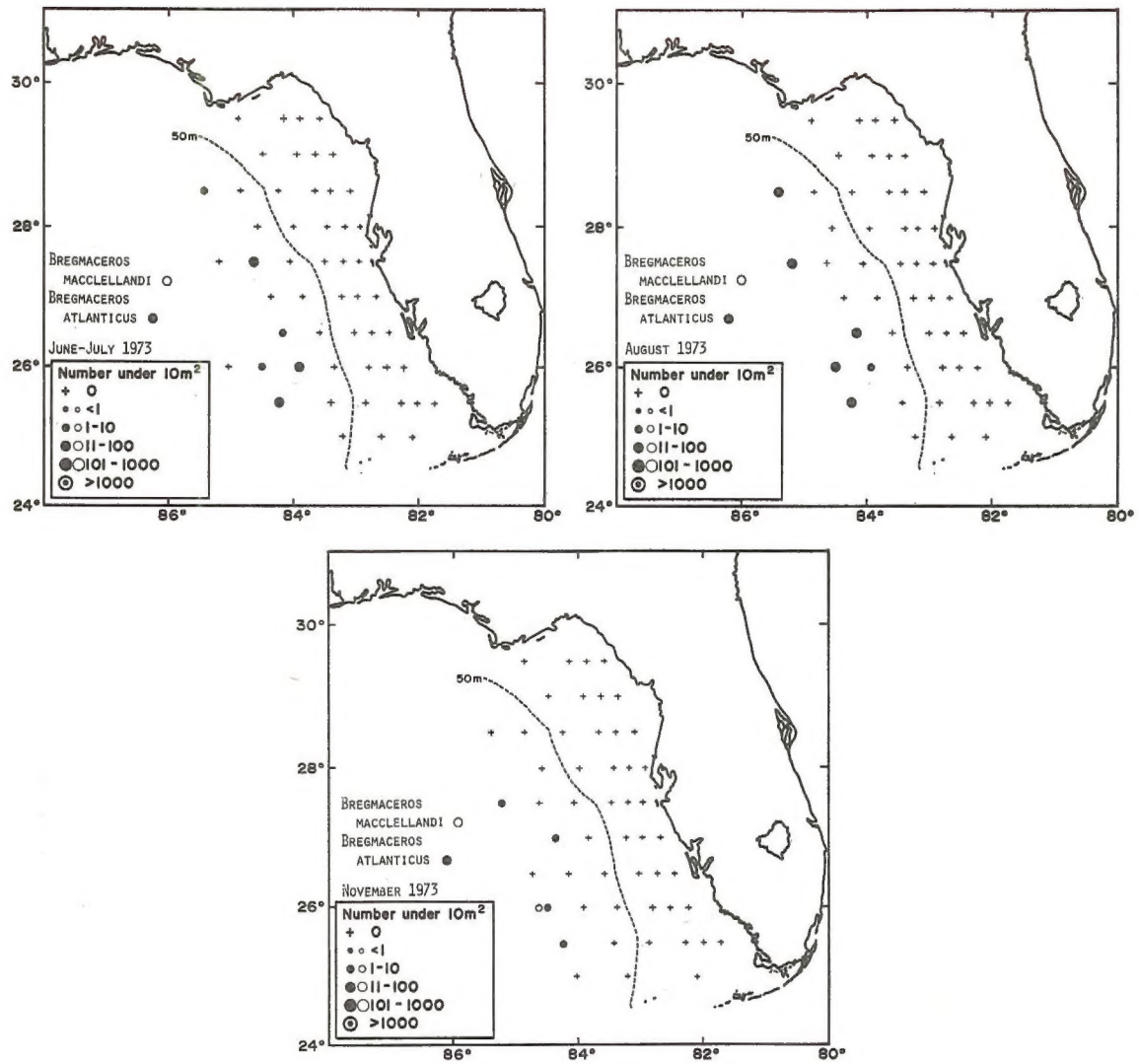


Fig. 71

Cont.

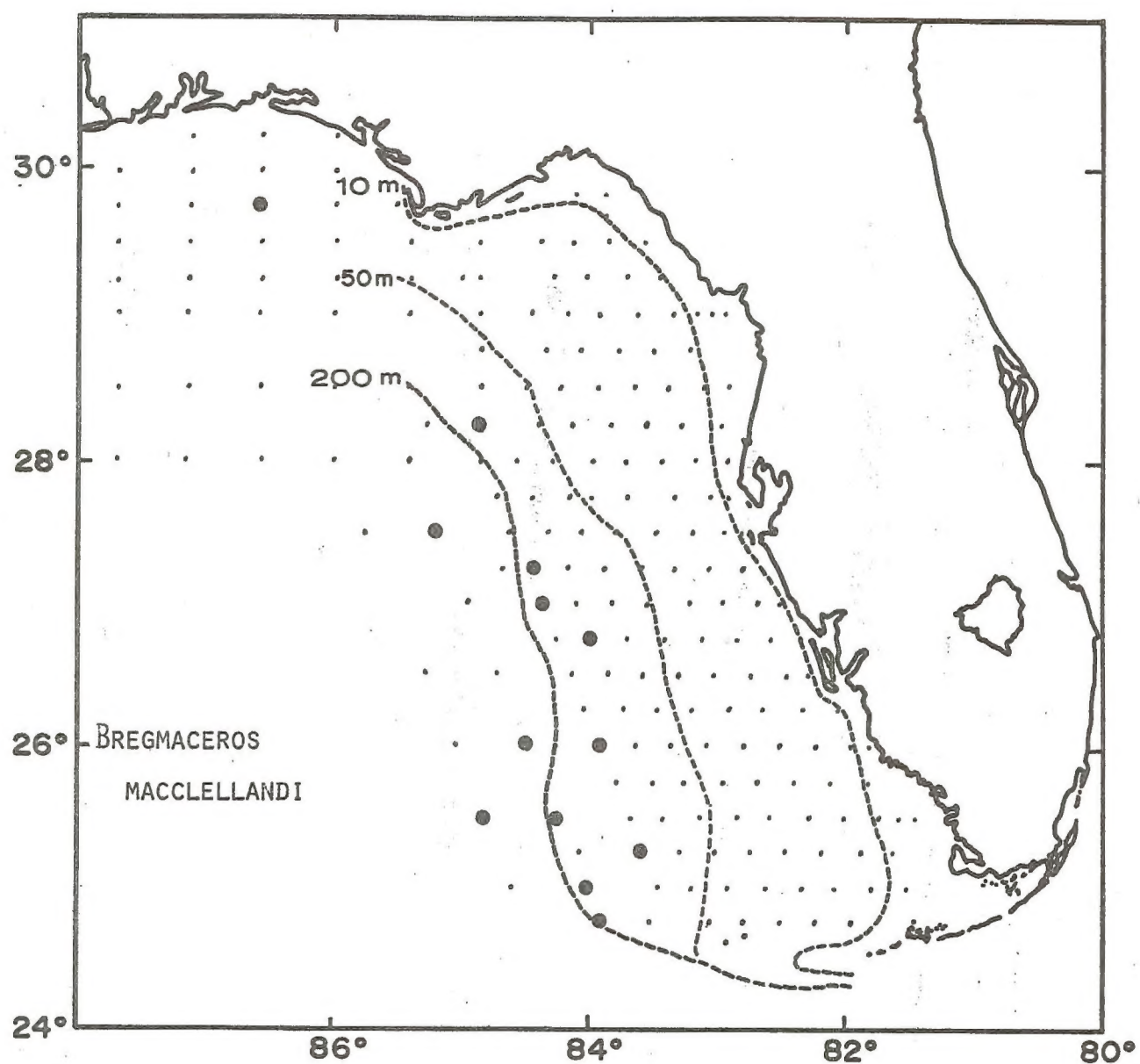


Fig. 72

Stations at which *Bregmaceros maclellandi* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

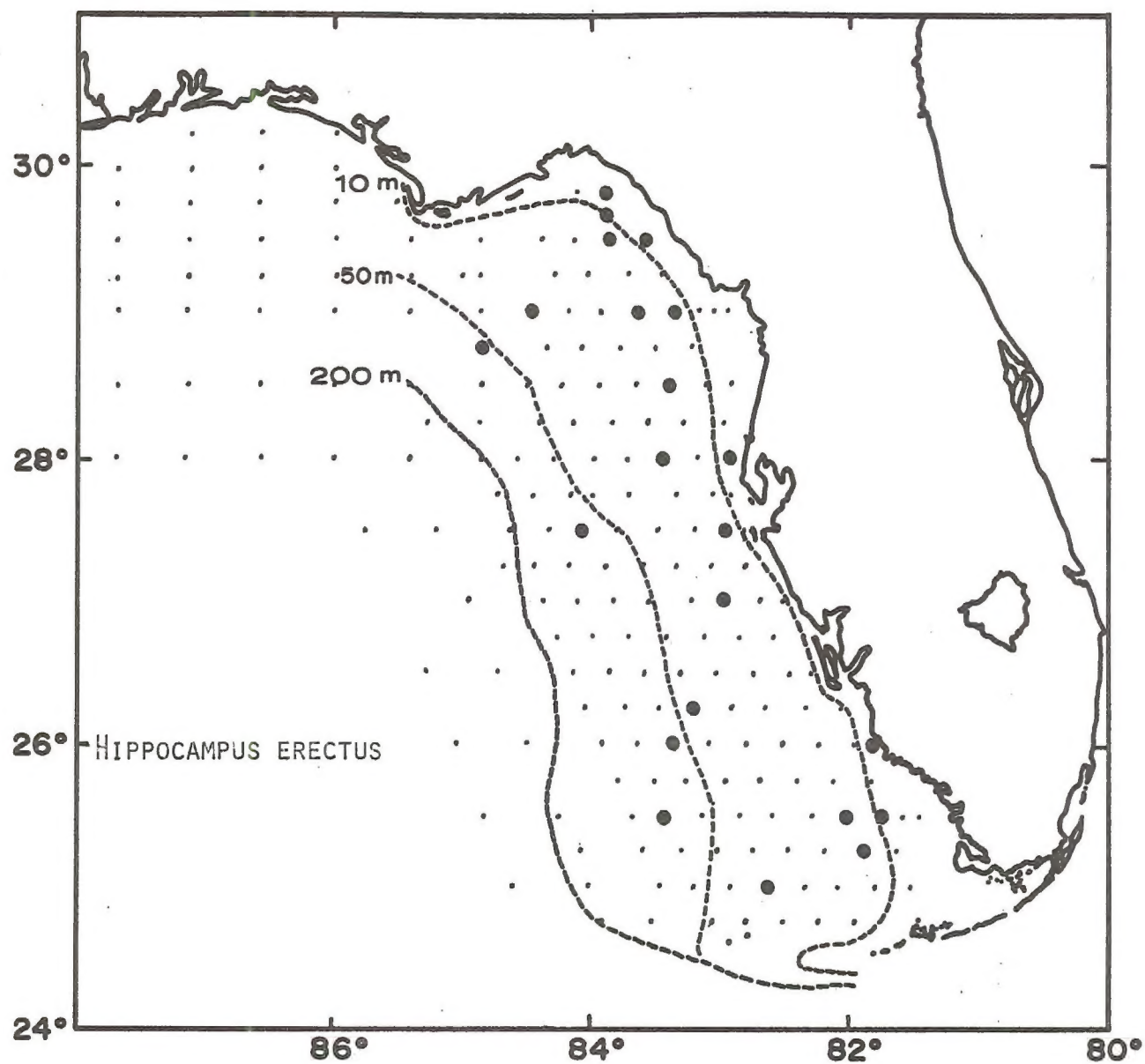


Fig. 73

Stations at which Hippocampus erectus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

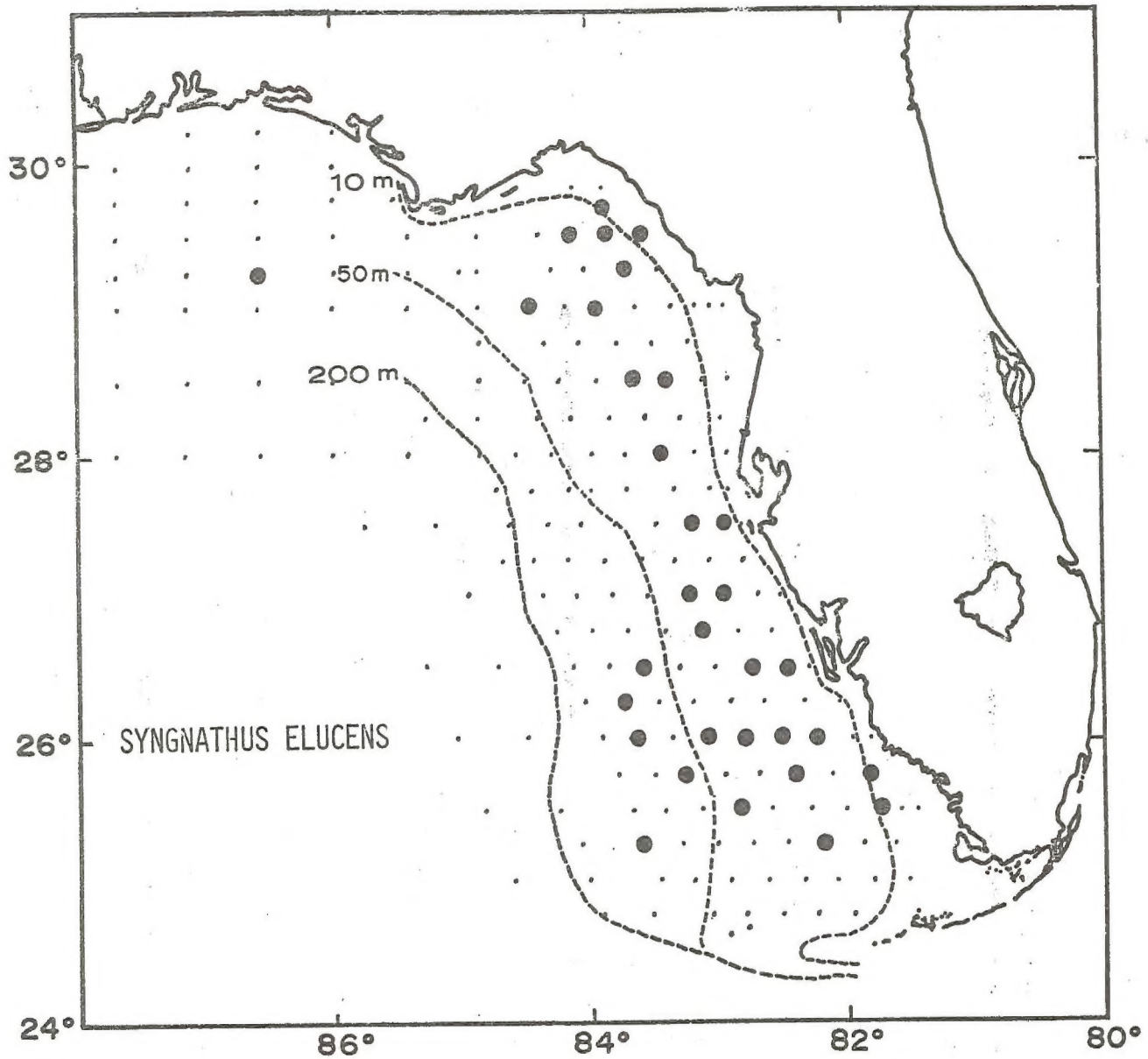


Fig. 74

Stations at which *Syngnathus elucens* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

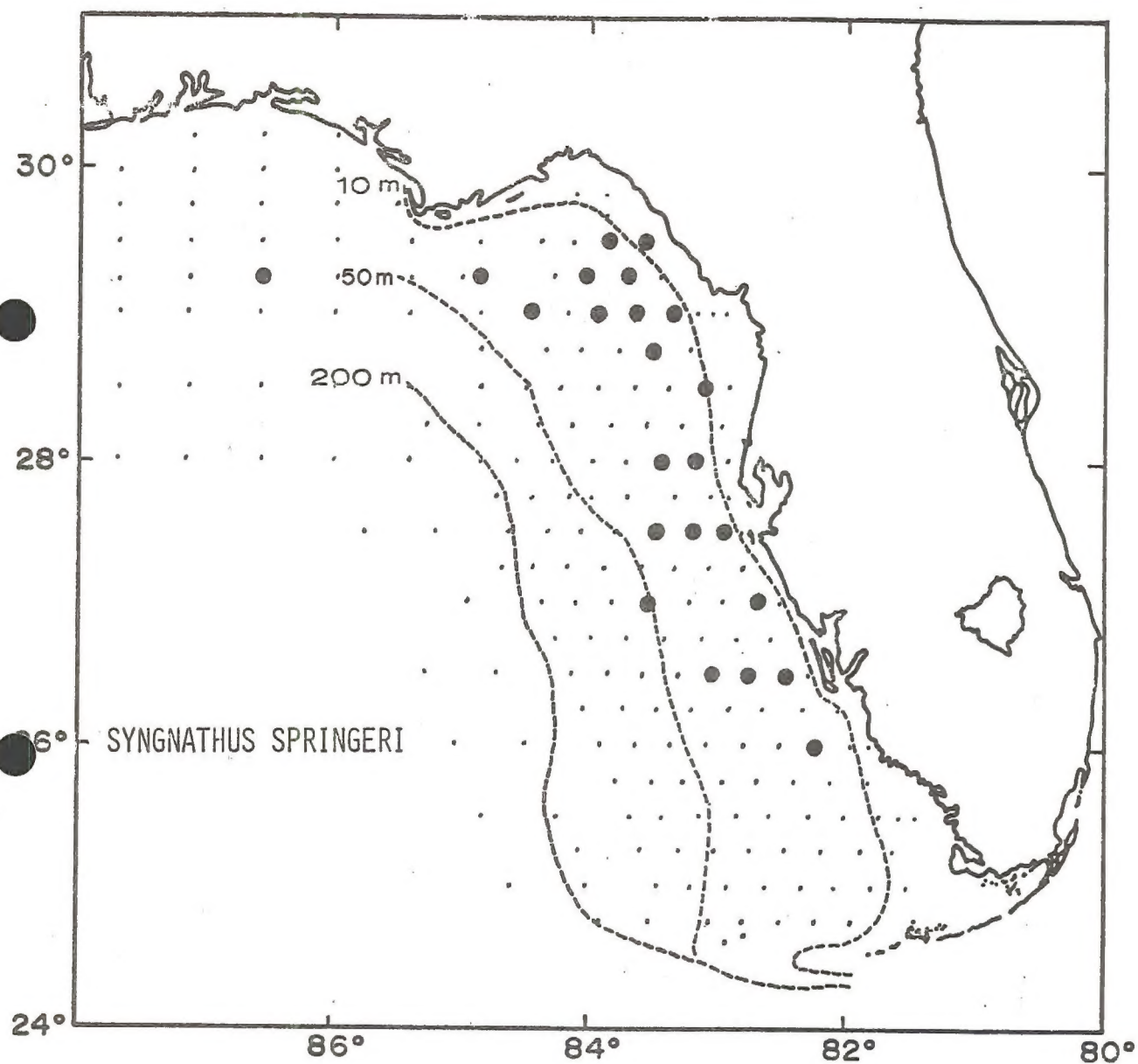


Fig. 75

Stations at which *Syngnathus springeri* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

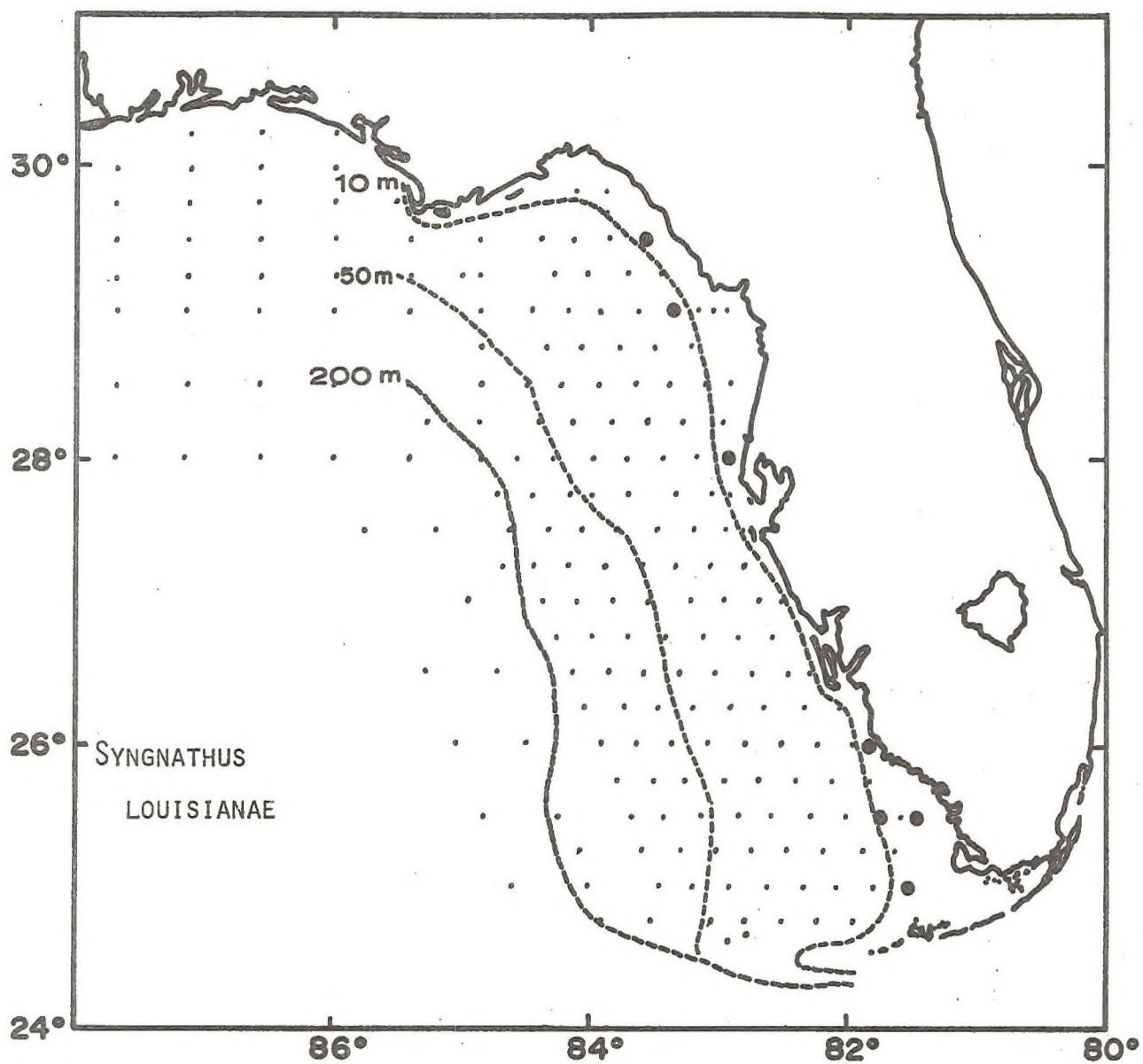


Fig. 76

Stations at which *Syngnathus louisianae* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

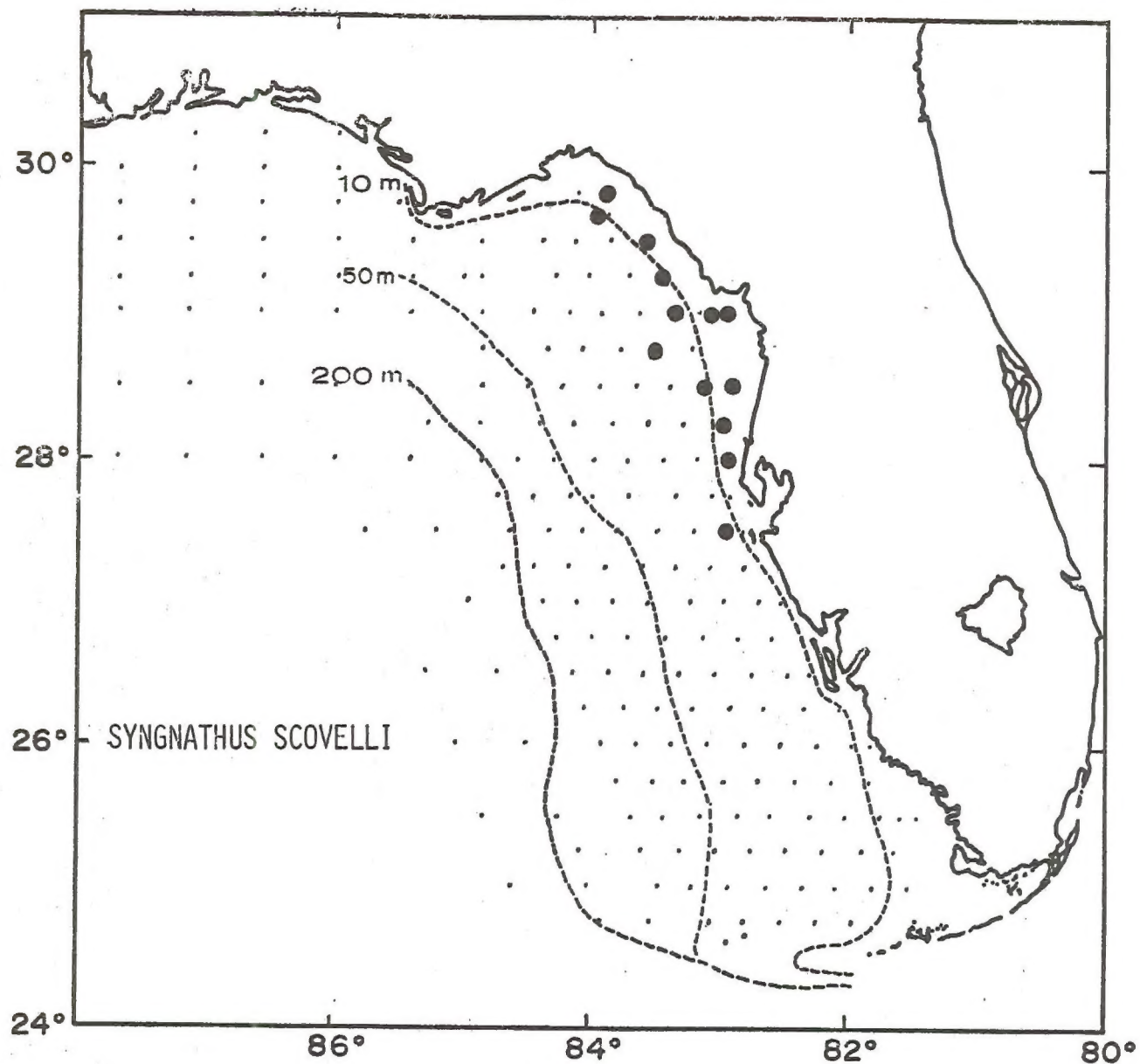


Fig. 77

Stations at which *Syngnathus scovelli* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

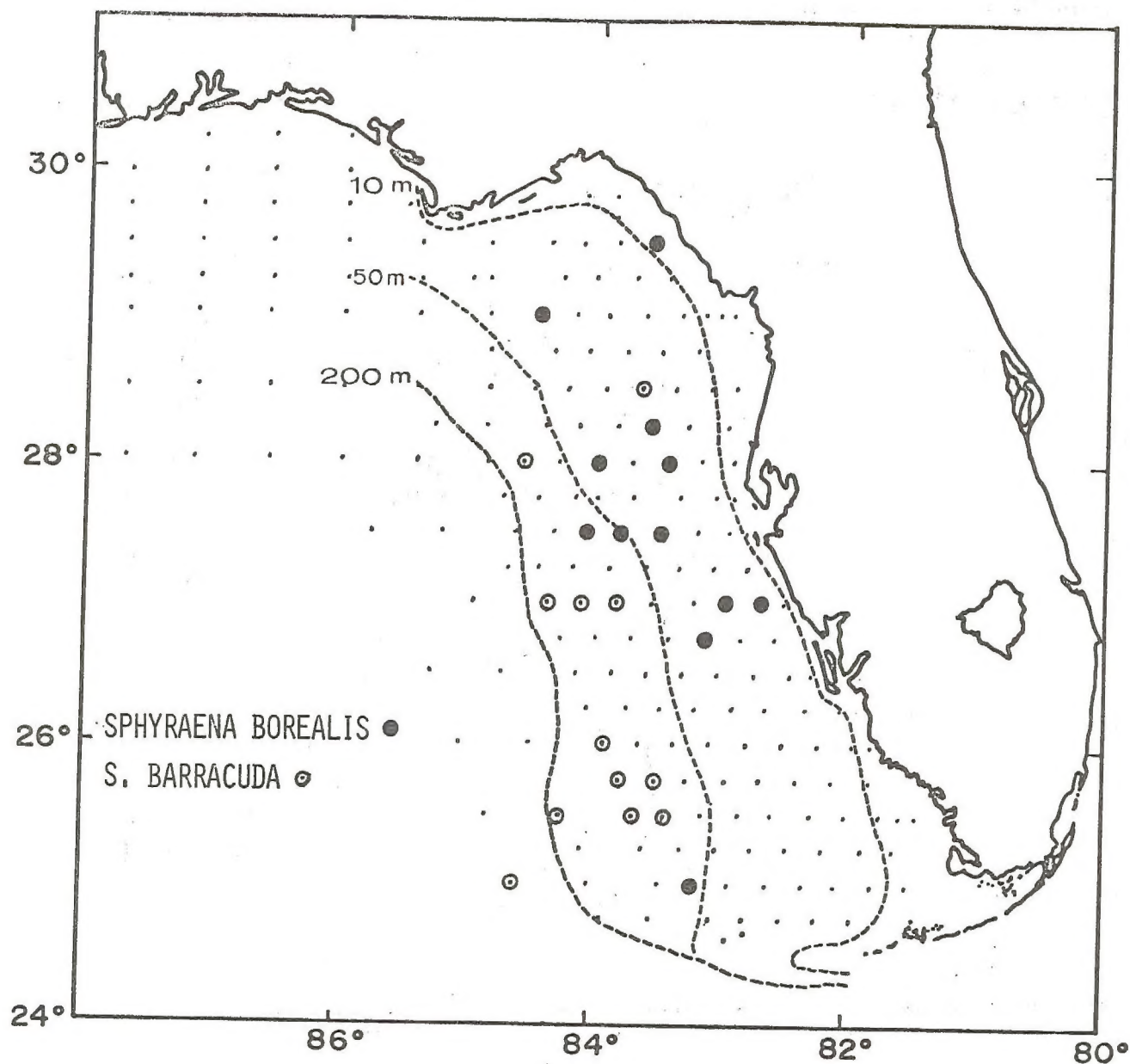


Fig. 78

Stations at which Sphyraena borealis and Sphyraena barracuda occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

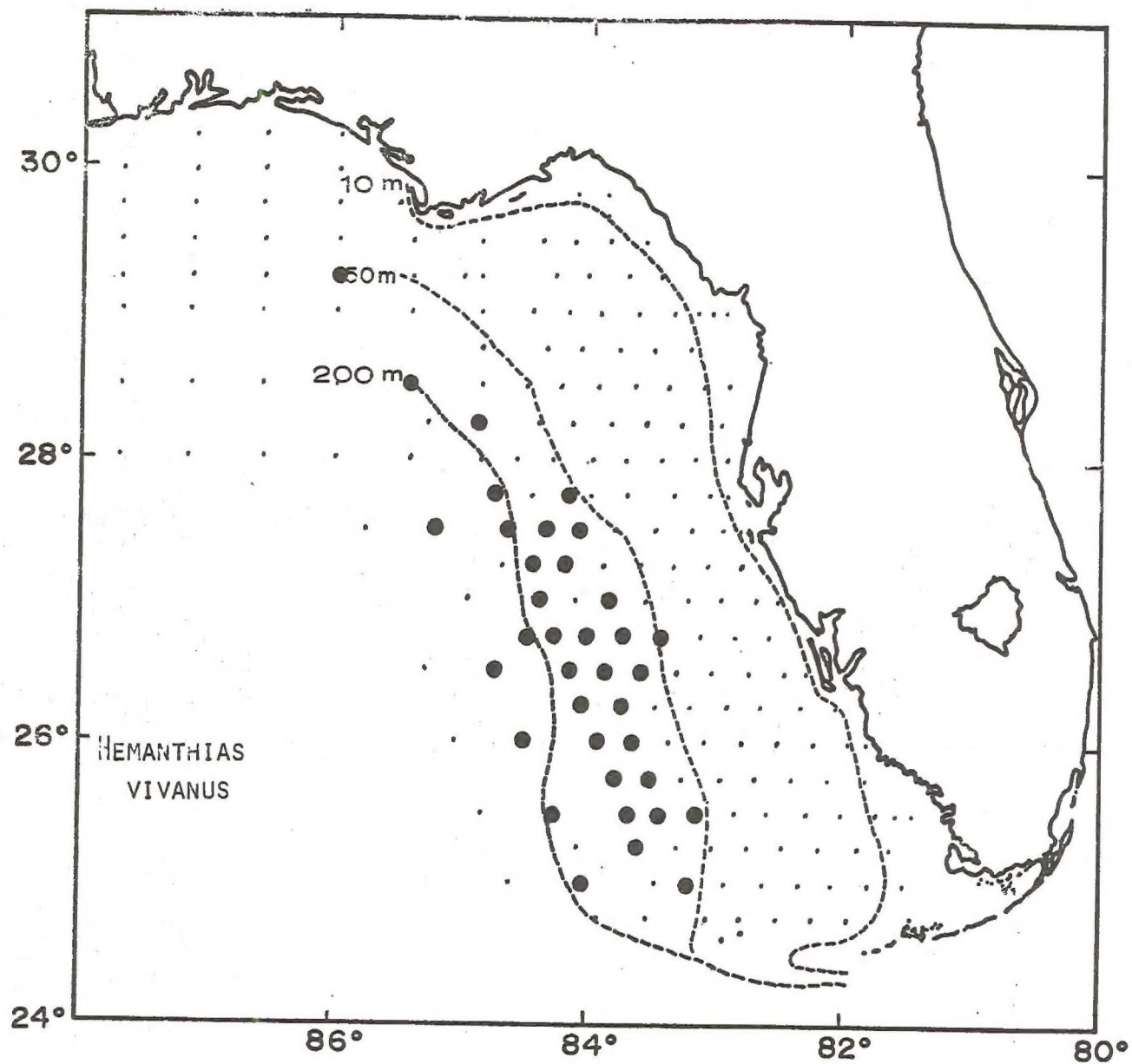


Fig. 79

Stations at which *Hemanthias vivanus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

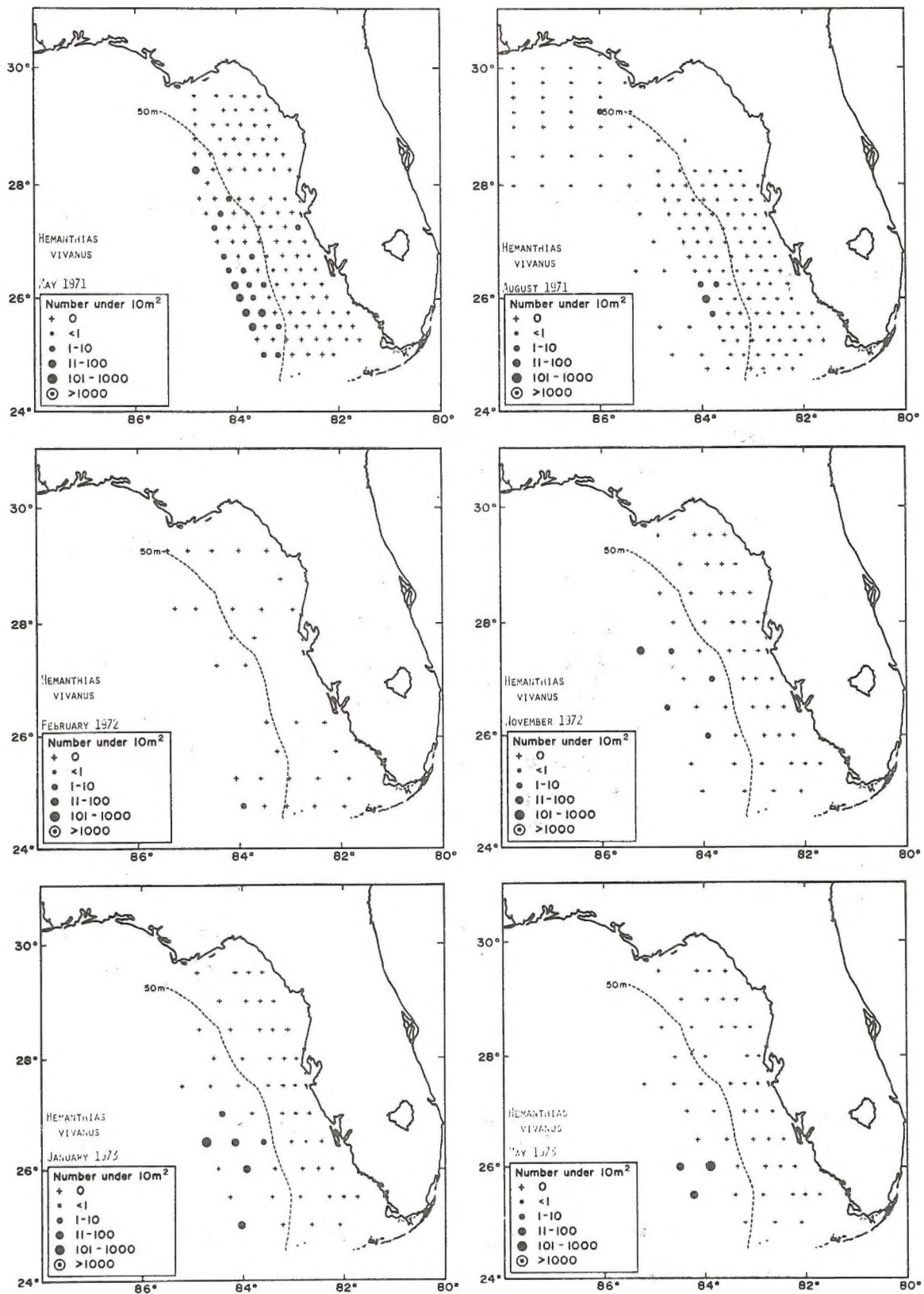


Fig. 80

Distribution and abundance of *Hemanthias vivanus* larvae in the eastern Gulf of Mexico, 1971-1974.

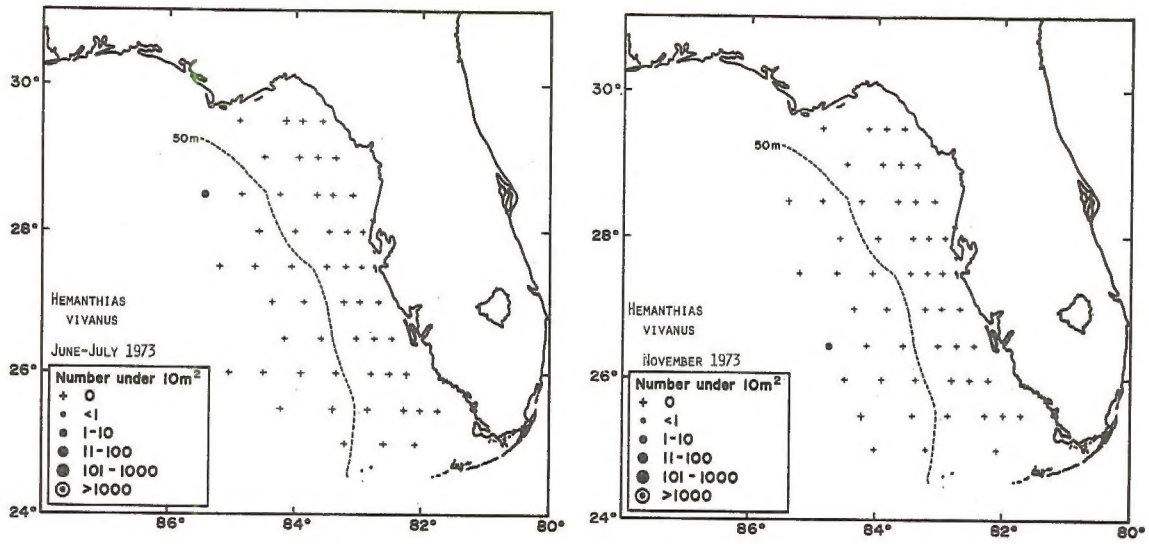
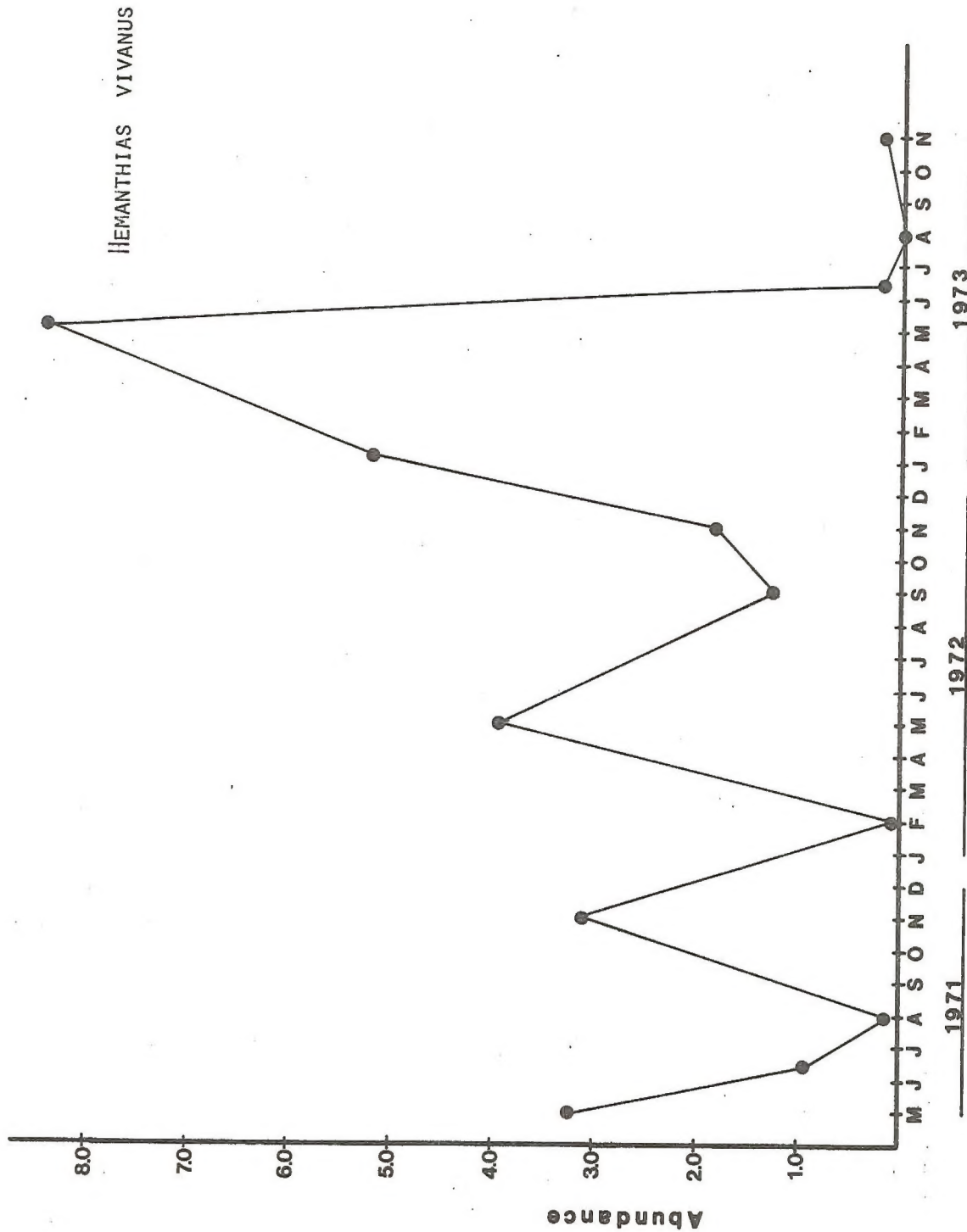


Fig. 80

Cont.



Cruise Date

Estimated mean abundances (number under 10 m^2 of sea surface) of *Hemanthias vivanus* larvae in the eastern Gulf of Mexico, 1971-1974.

Fig. 81

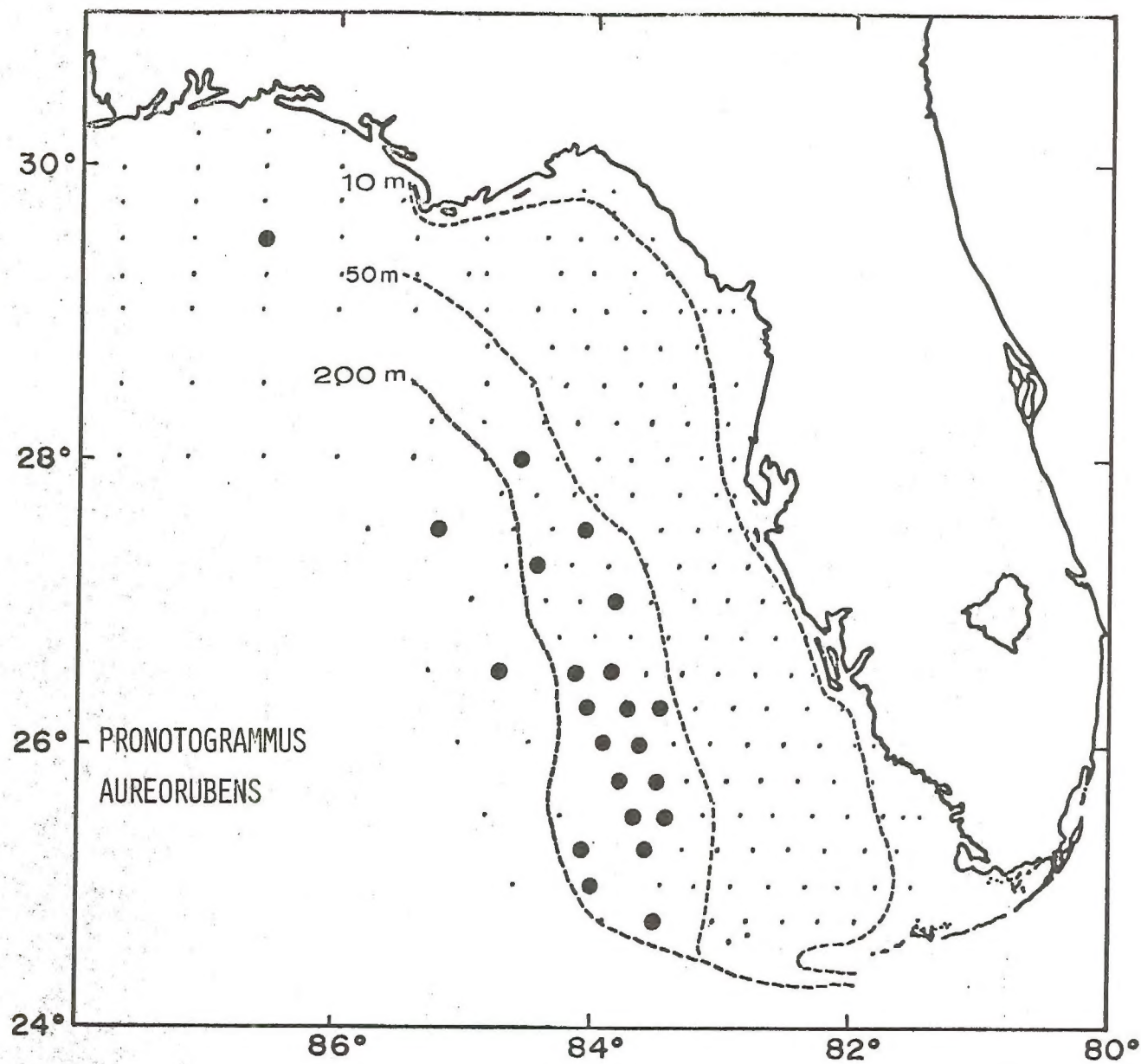


Fig. 82

Stations at which Pronotogrammus aureorubens larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974,

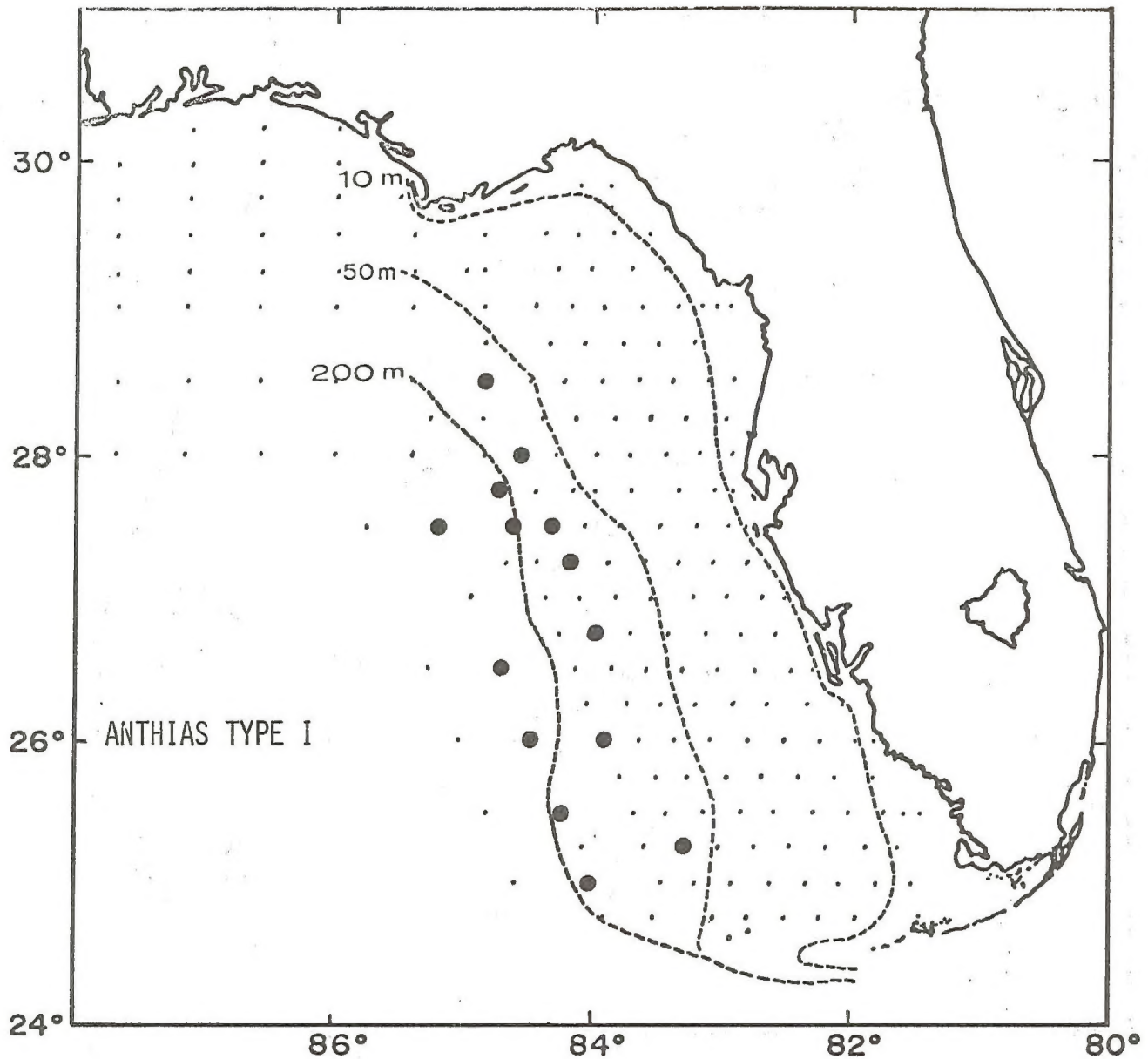


Fig. 83

Stations at which *Anthias* Type I larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

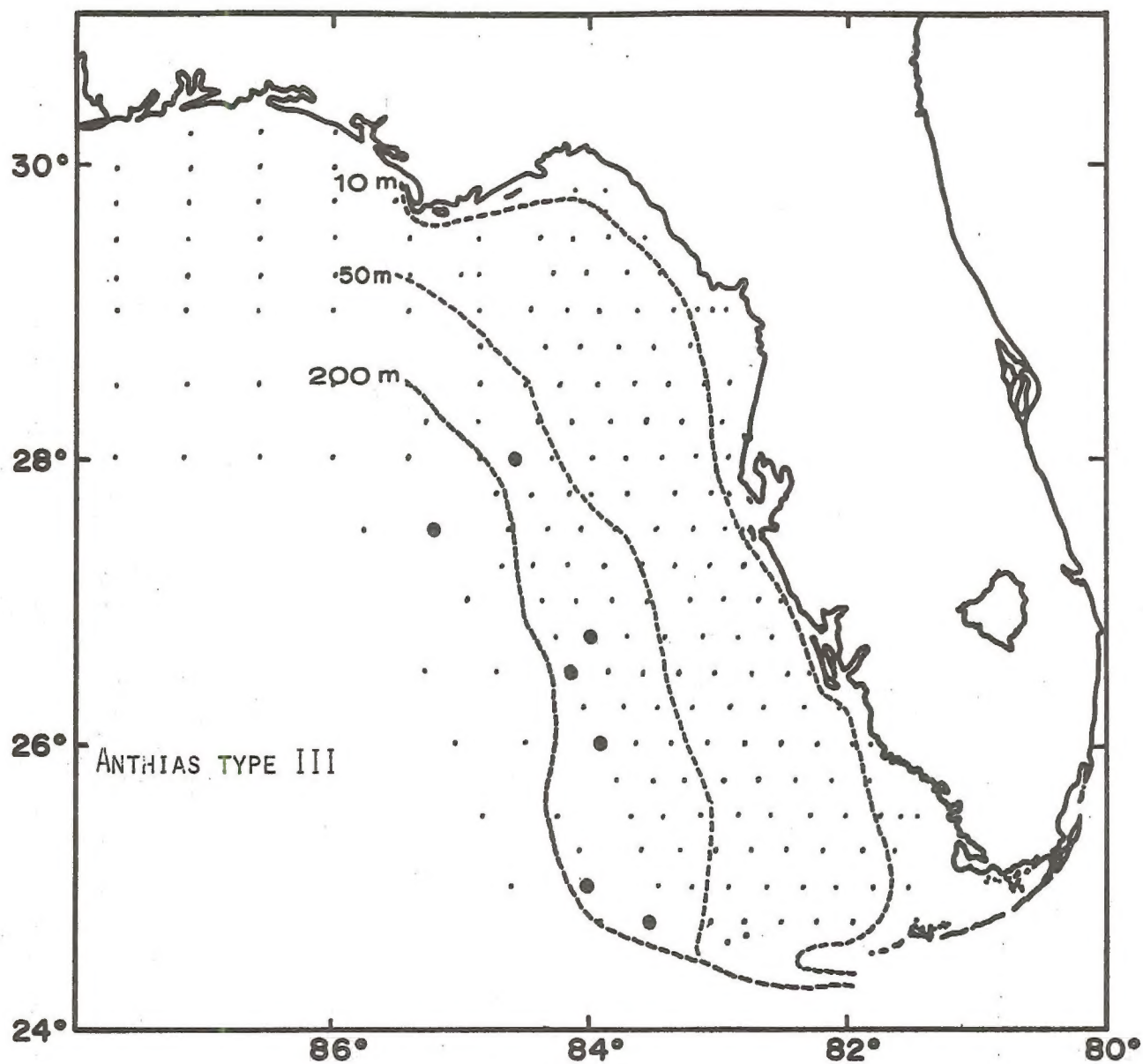


Fig. 84

Stations at which *Anthias* Type III larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

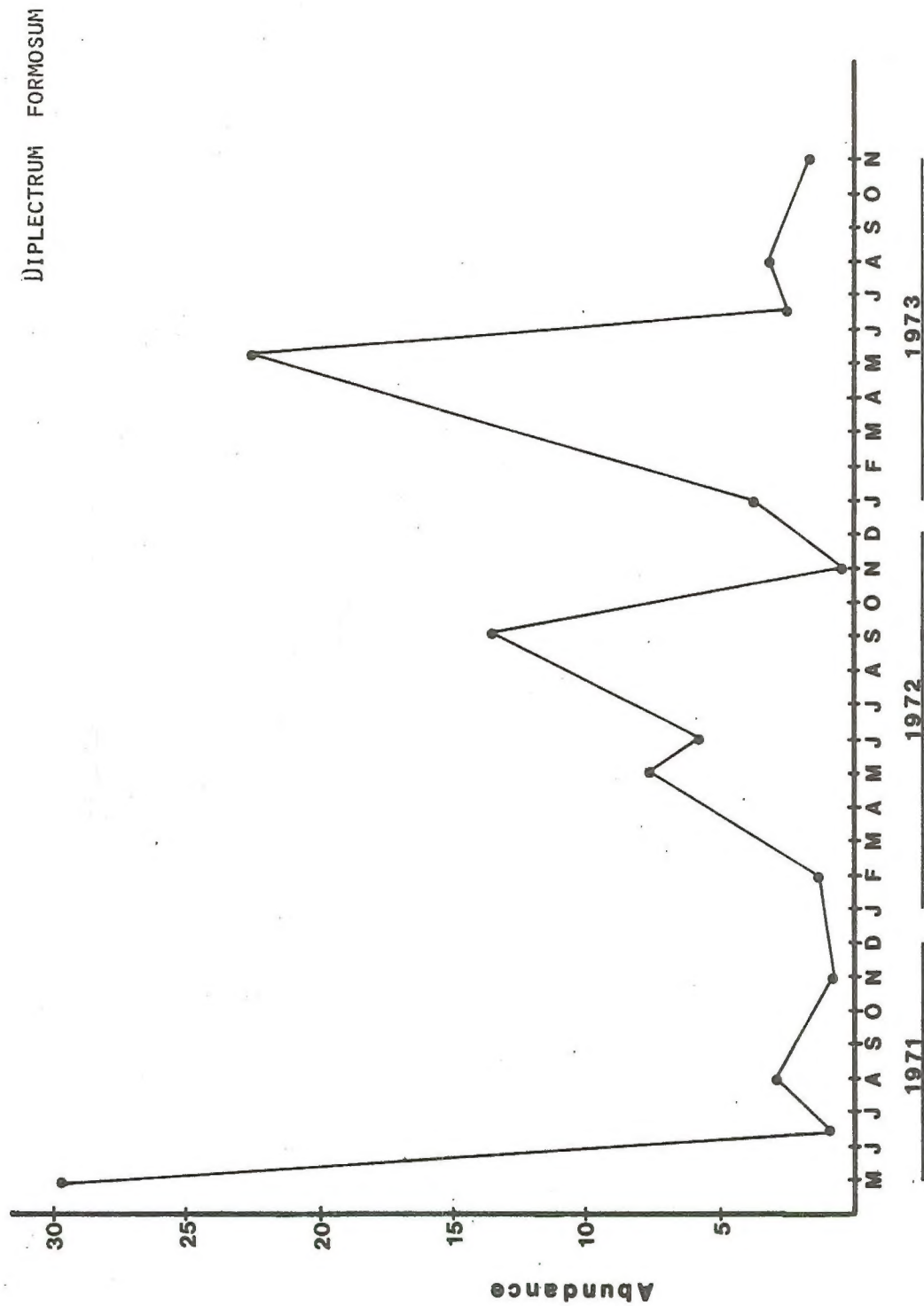


Fig. 85 Estimated mean abundances (number under 10 m^2 of sea surface) of *Diplectrum formosum* larvae in the eastern Gulf of Mexico, 1971-1974.

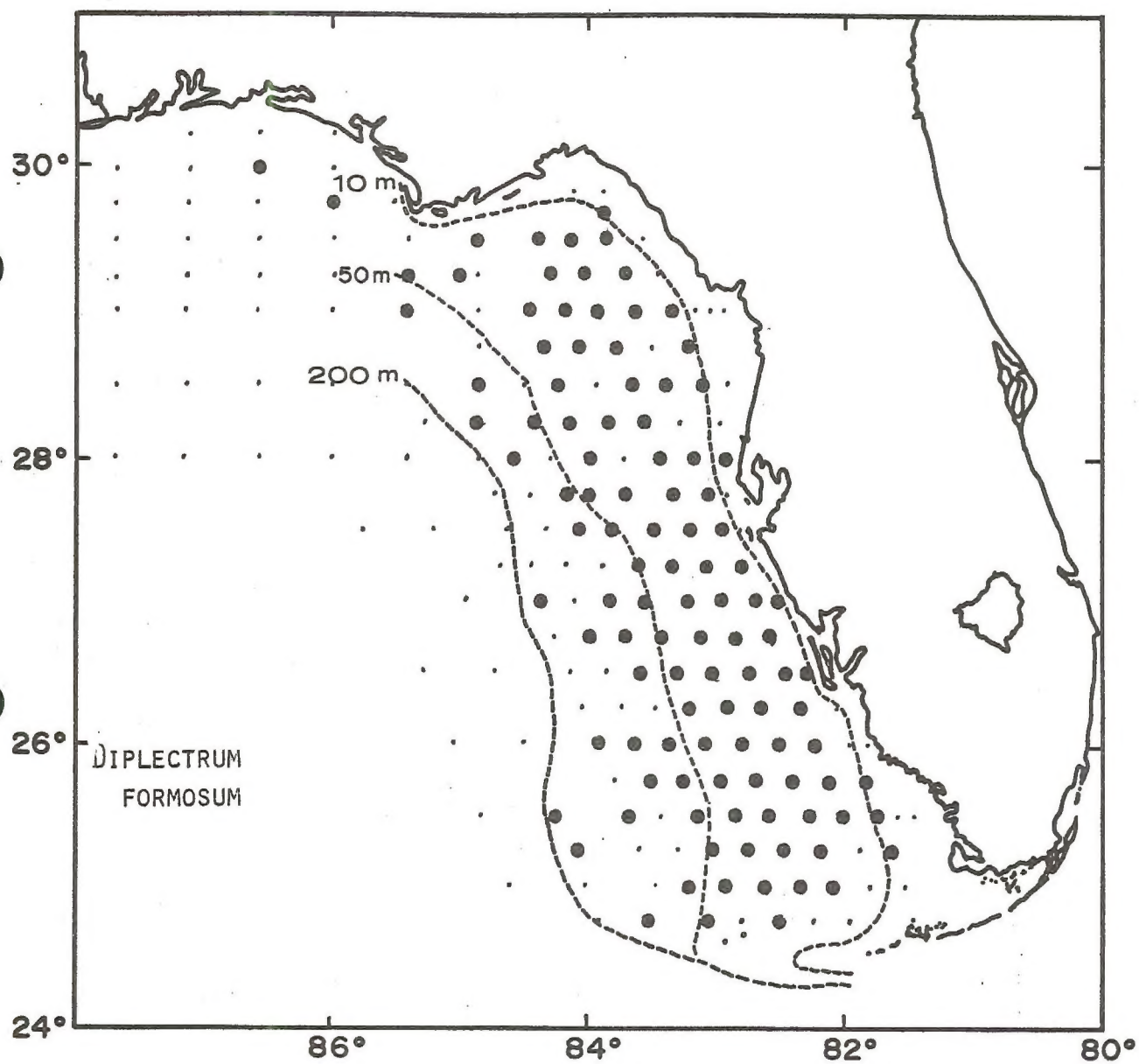


Fig. 86

Stations at which *Diplectrum formosum* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

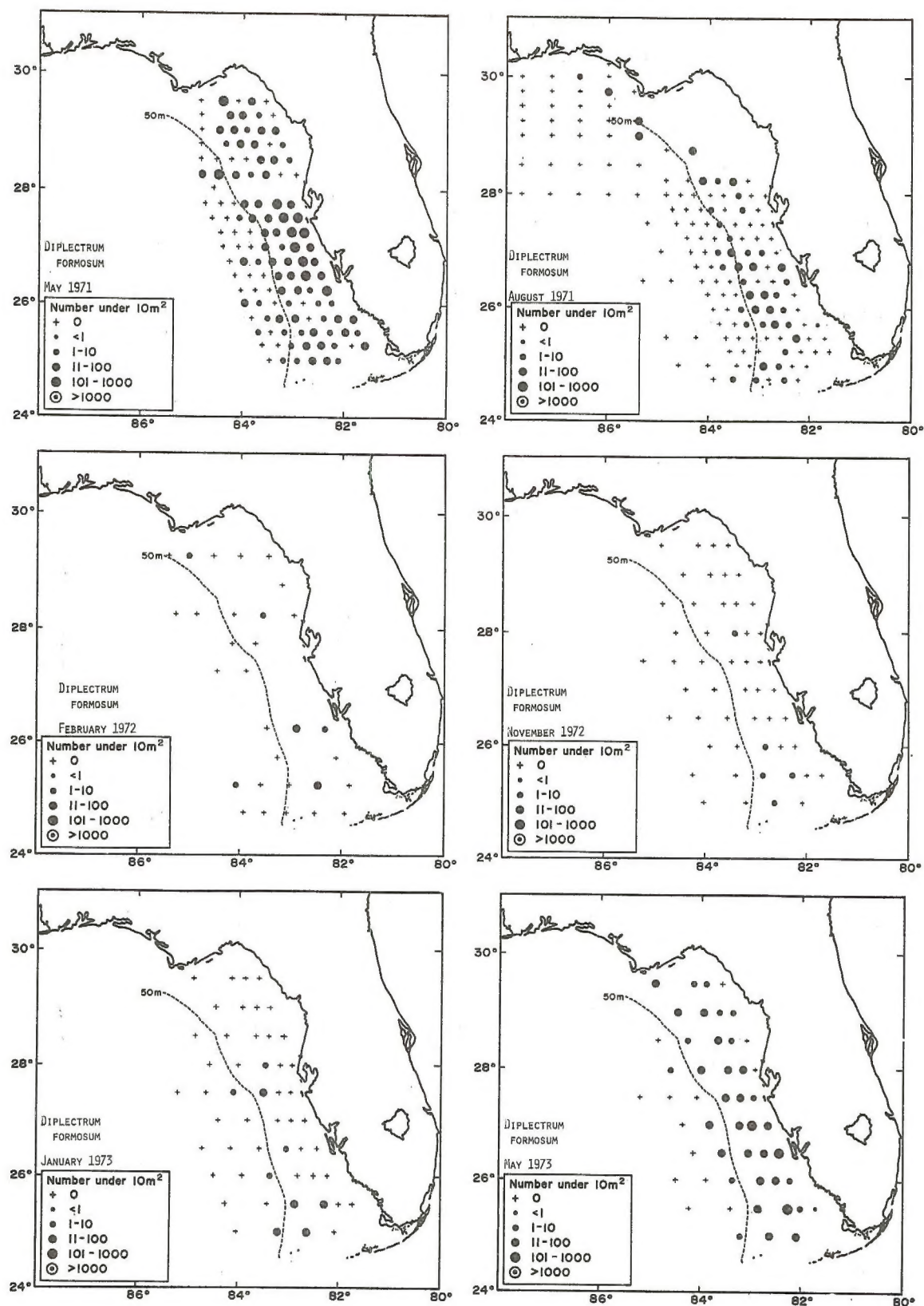


Fig. 87 Distribution and abundance of *Diplectrum formosum* larvae in the eastern Gulf of Mexico, 1971-1974.

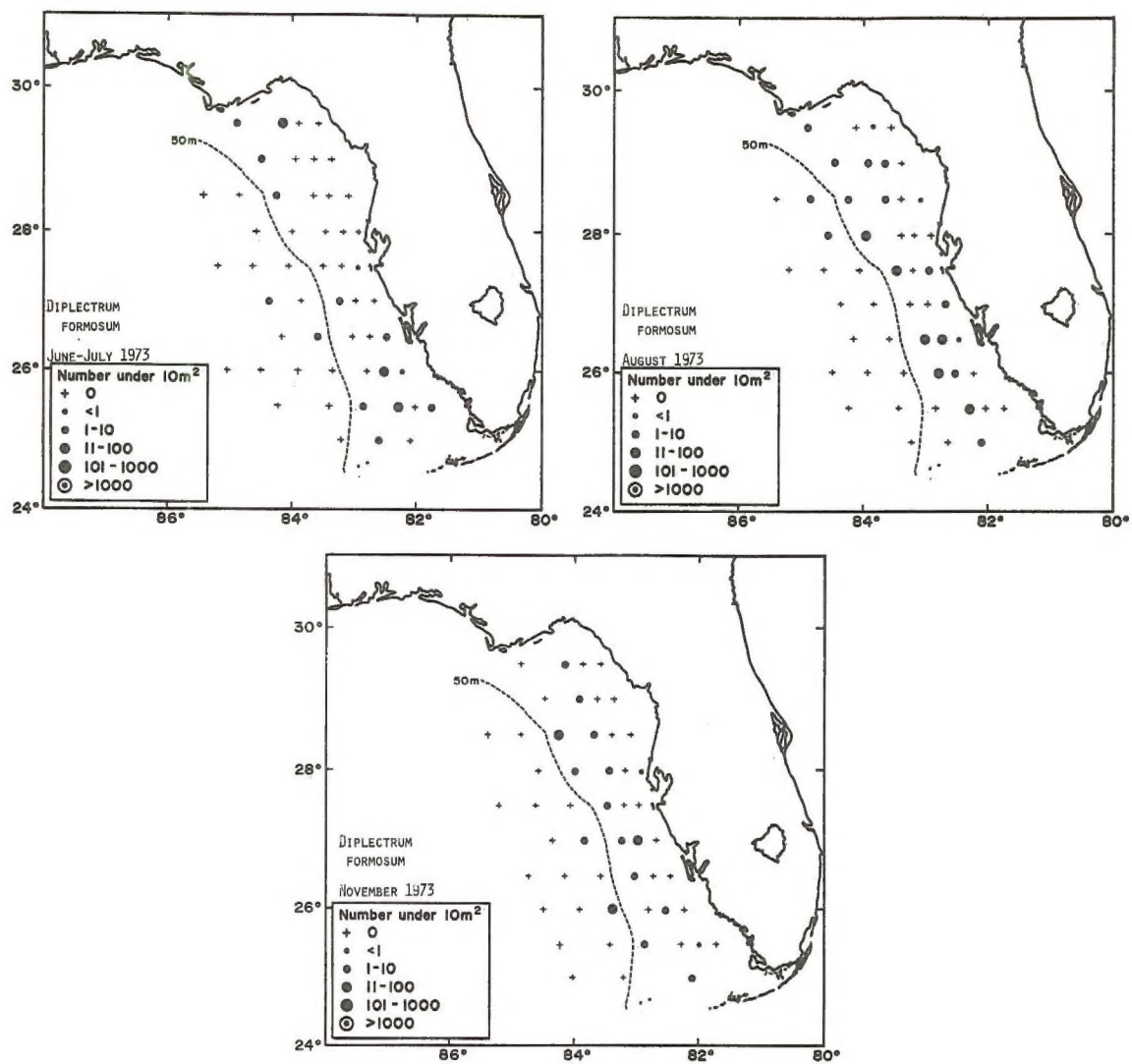


Fig. 87

Cont.

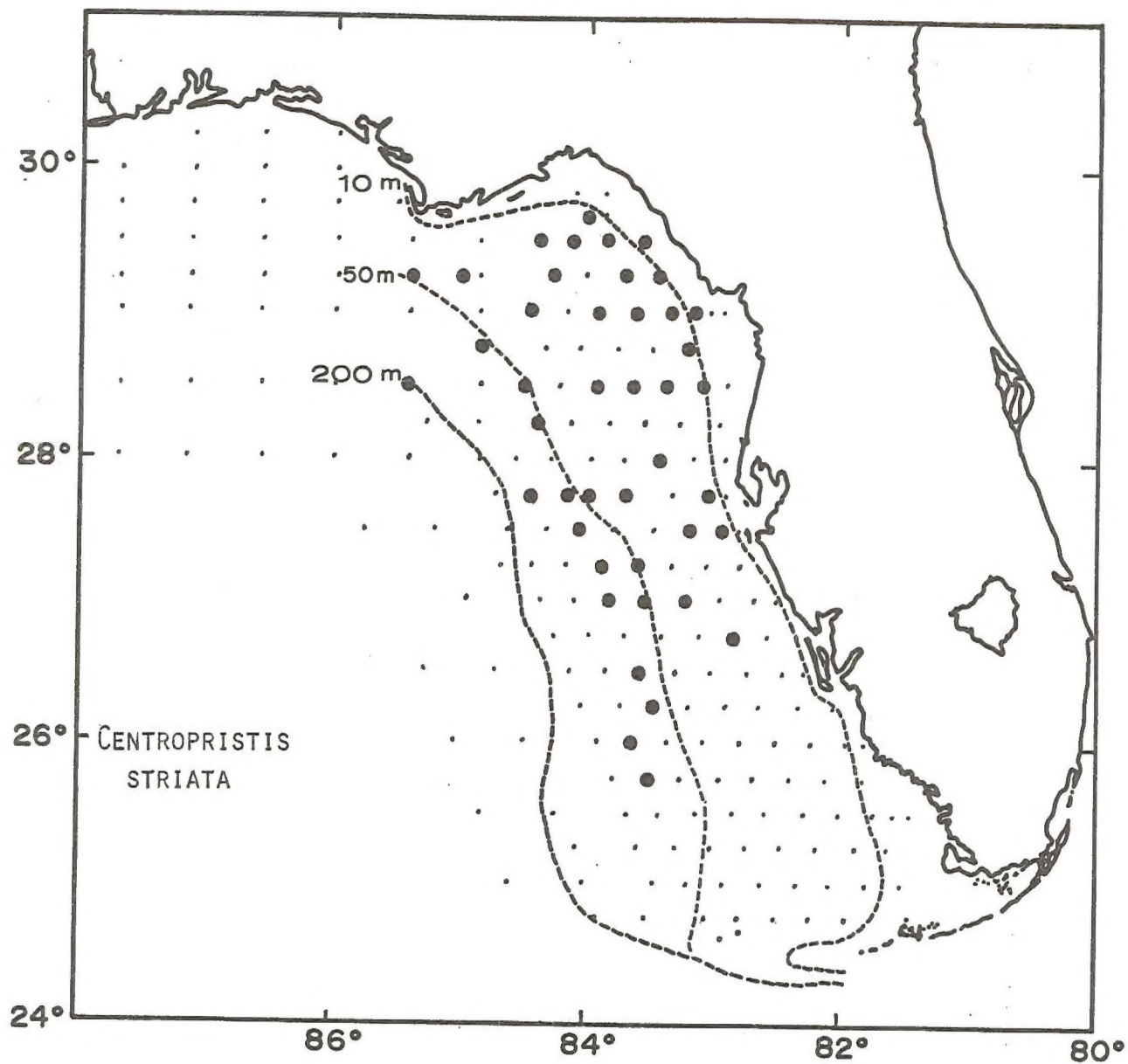


Fig. 88

Stations at which *Centropristis striata* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

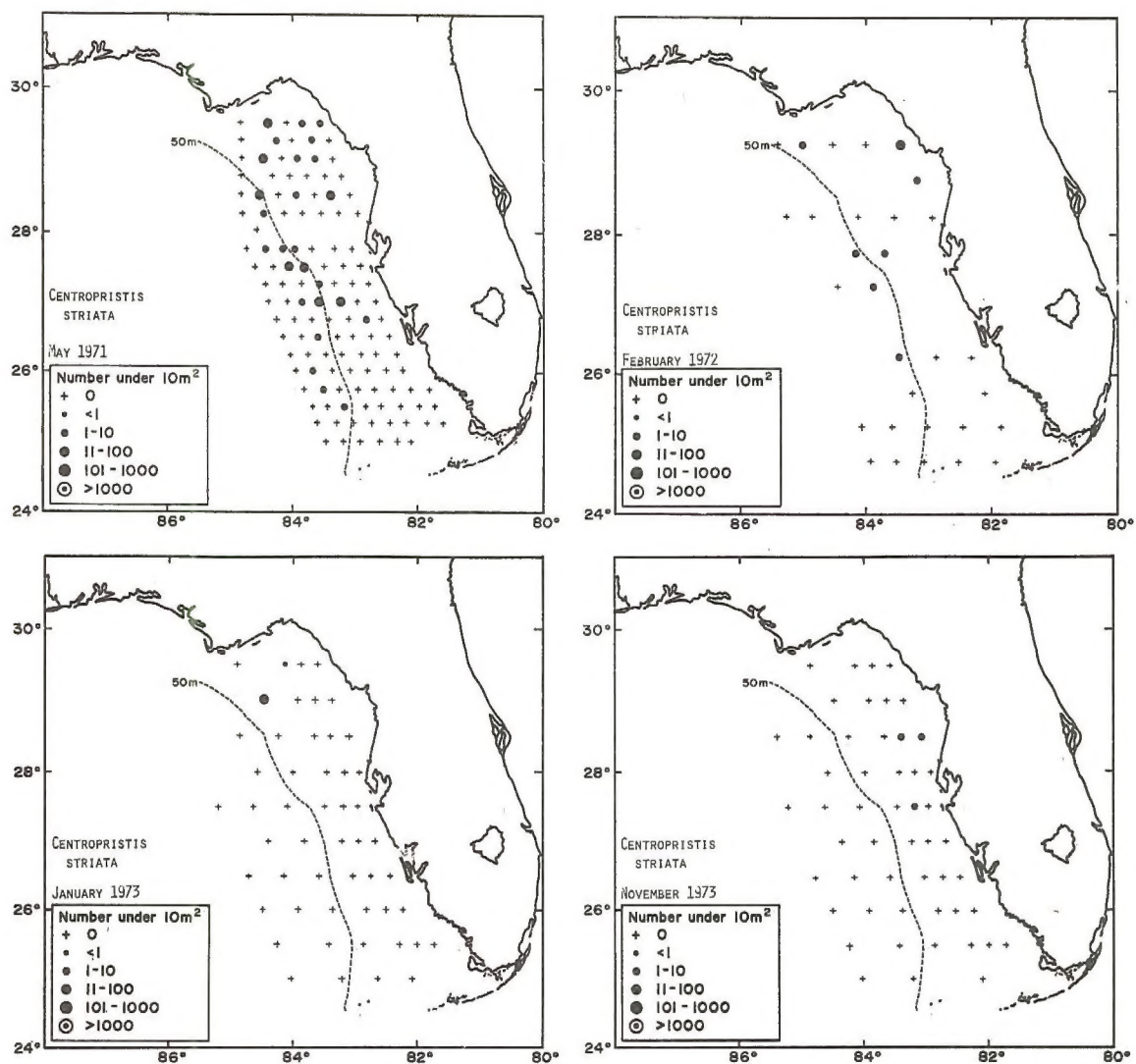


Fig. 89

Distribution and abundance of *Centropristis striata* larvae in the eastern Gulf of Mexico, 1971-1974.

SERRANICULUS PUMILIO

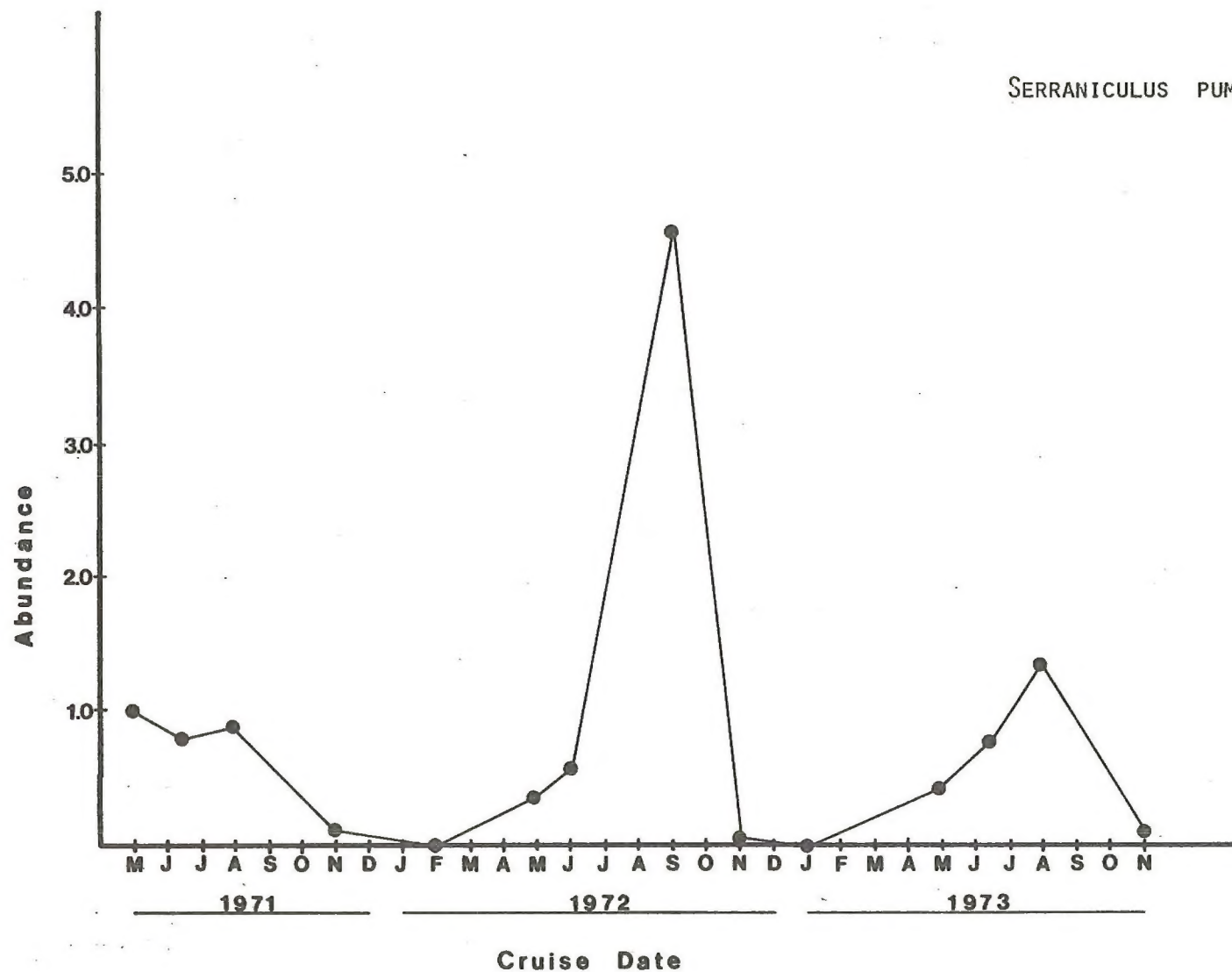


Fig. 90

Estimated mean abundances (number under 10 m² of sea surface) of *Serraniculus pumilio* larvae in the eastern Gulf of Mexico, 1971-1974.

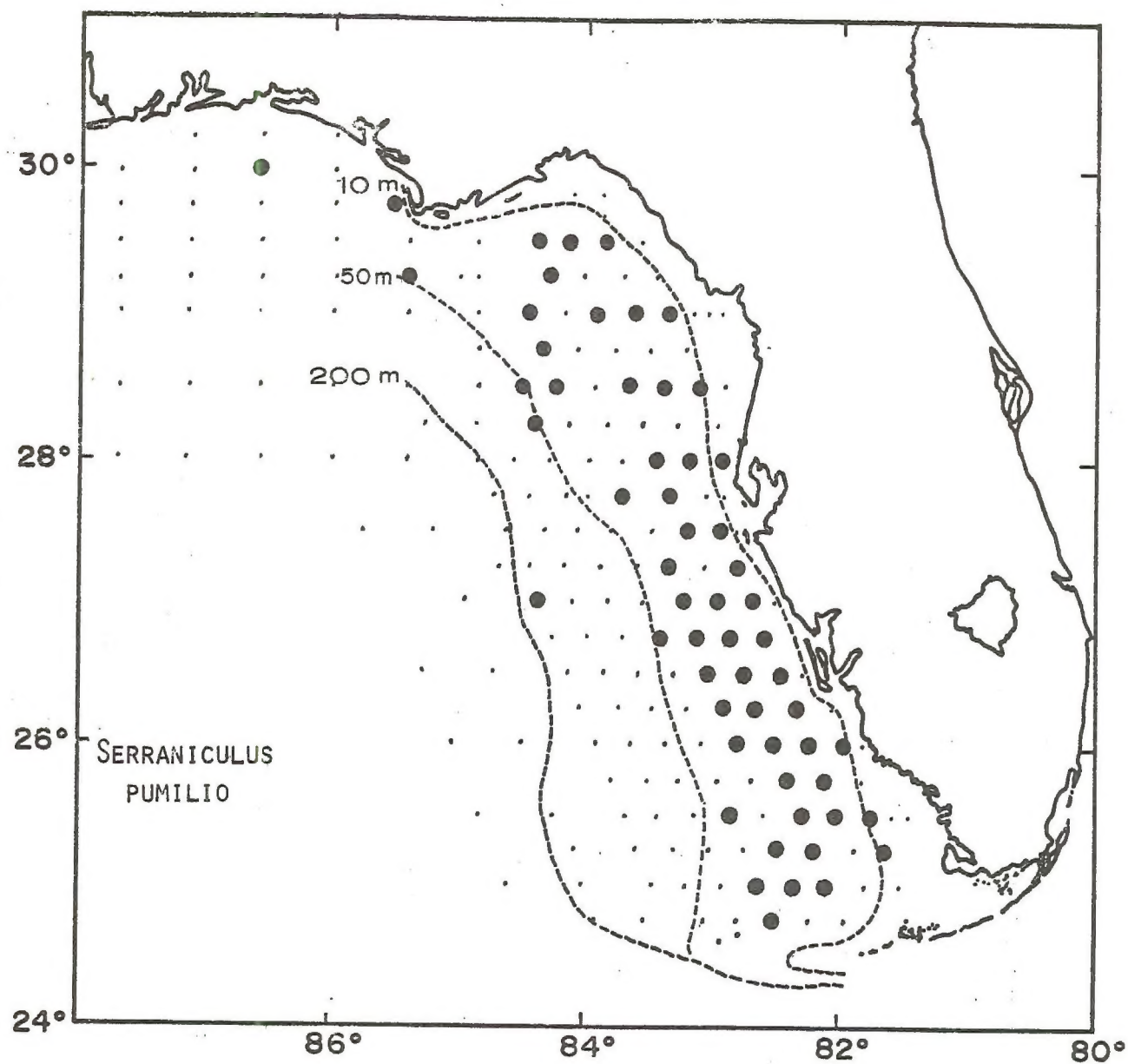


Fig. 91

Stations at which *Serraniculus pumilio* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

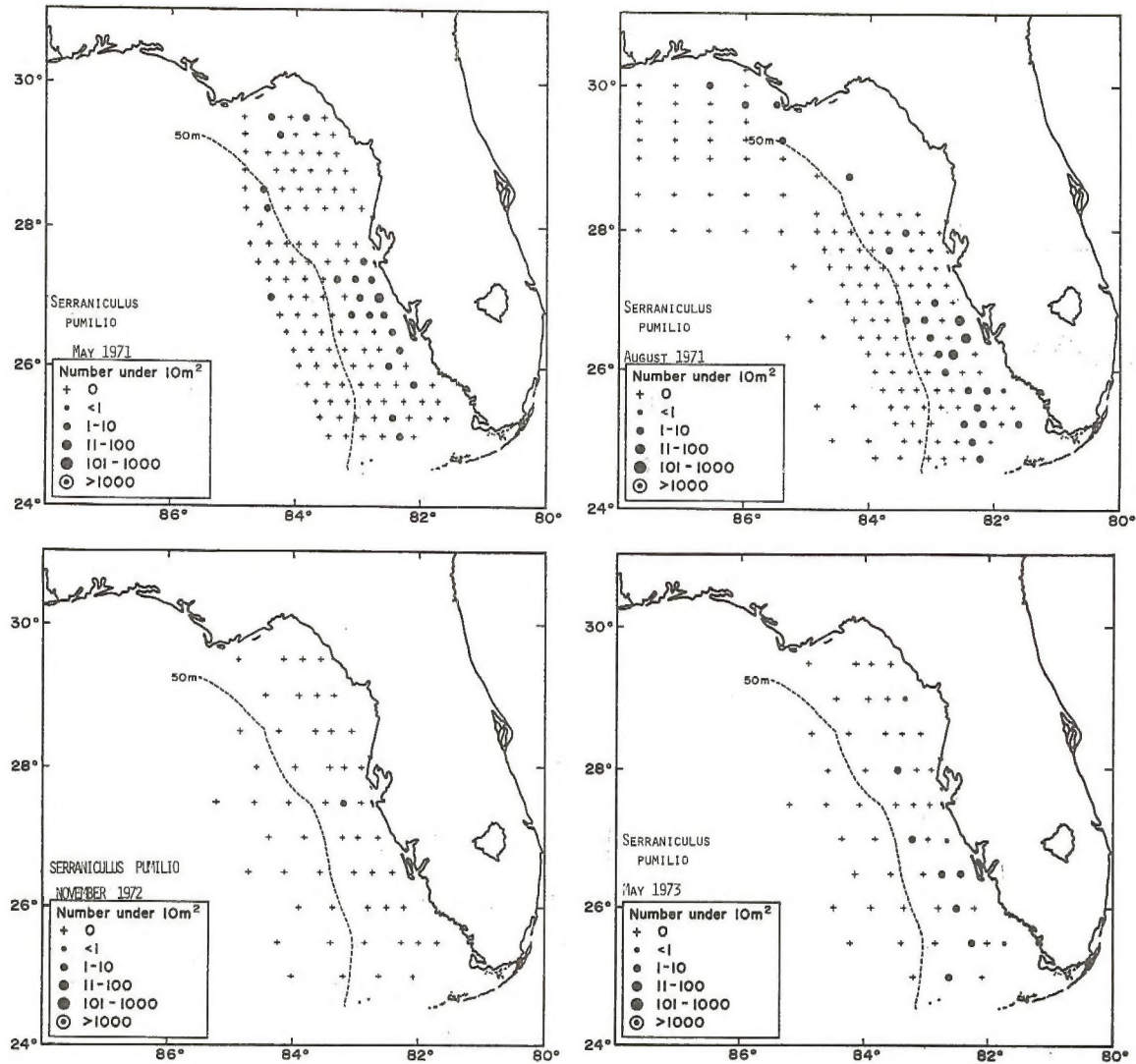


Fig. 92 Distribution and abundance of *Serraniculus pumilio* larvae in the eastern Gulf of Mexico, 1971-1974.

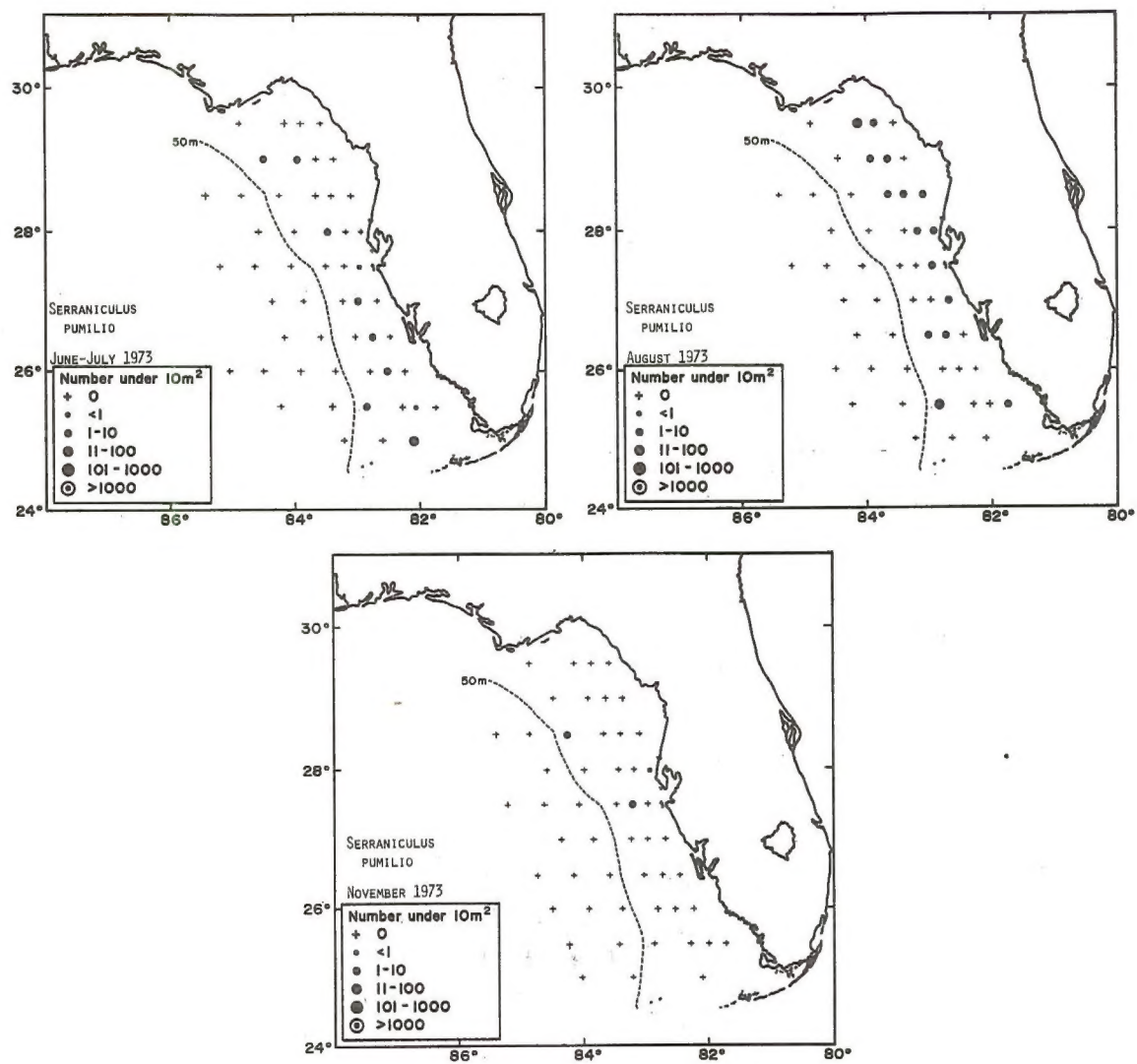


Fig. 92

Cont.

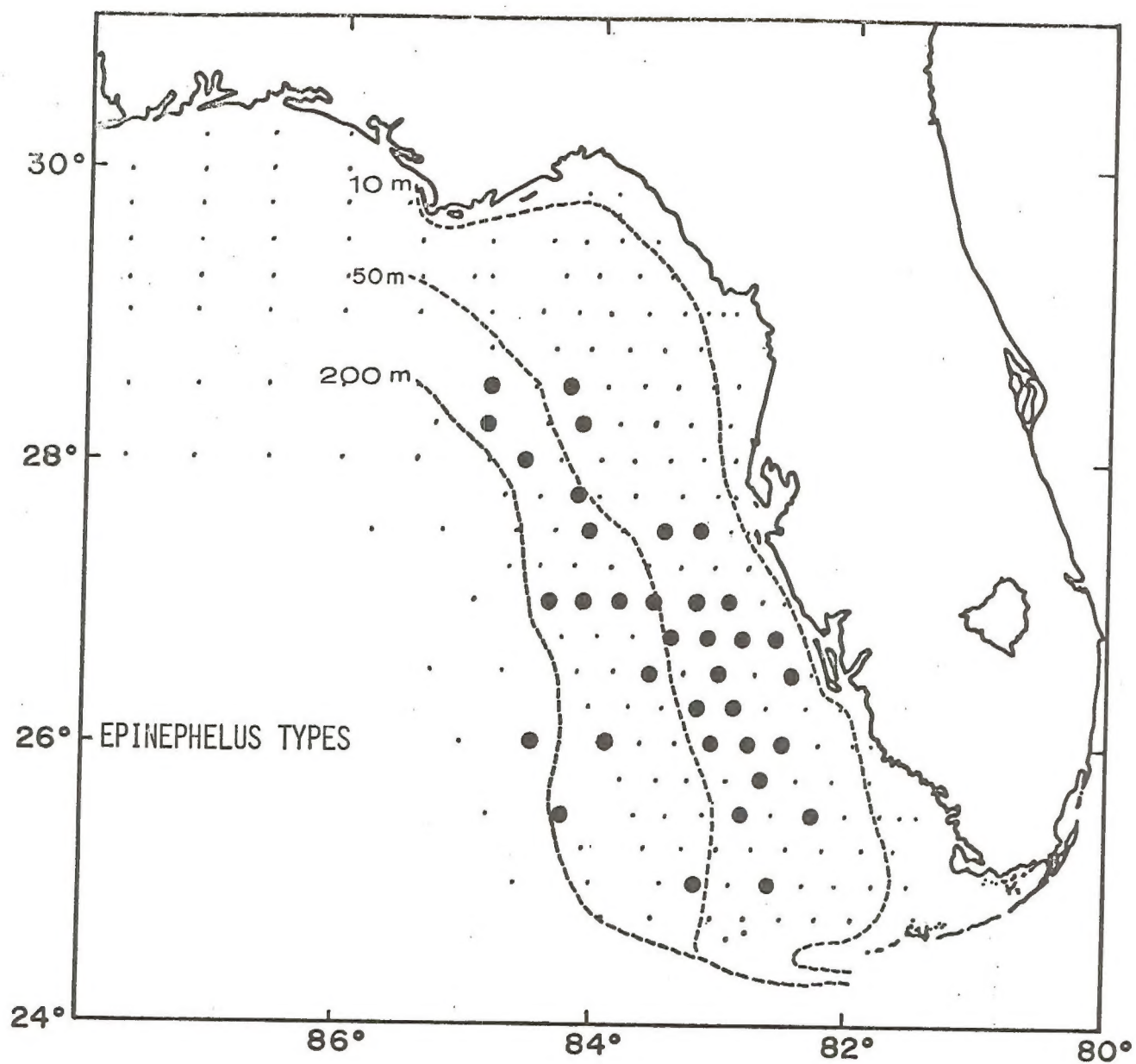


Fig. 93

Stations at which Epinephelus types of larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

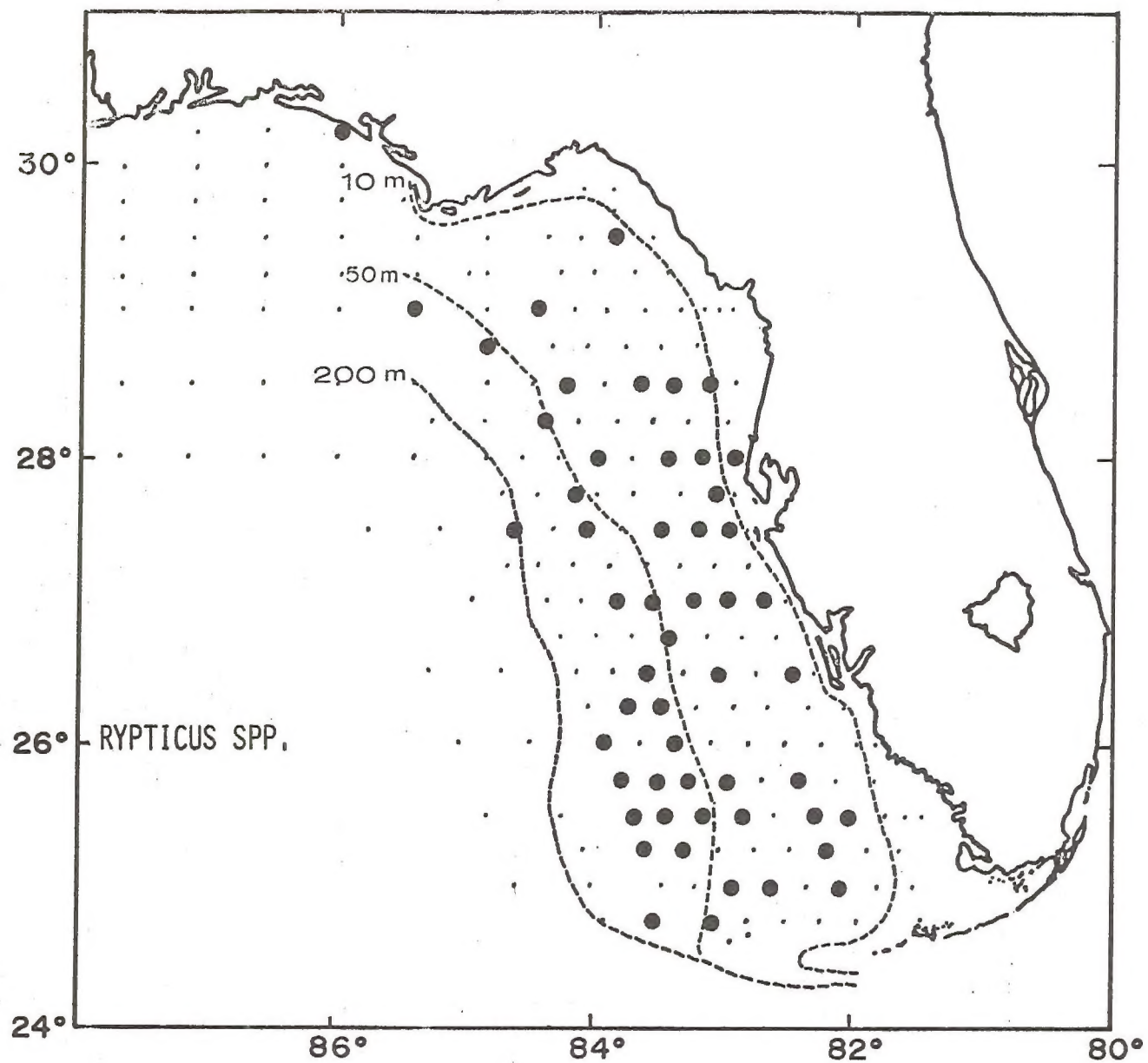


Fig. 94

Stations at which *Rypiticus* spp. larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

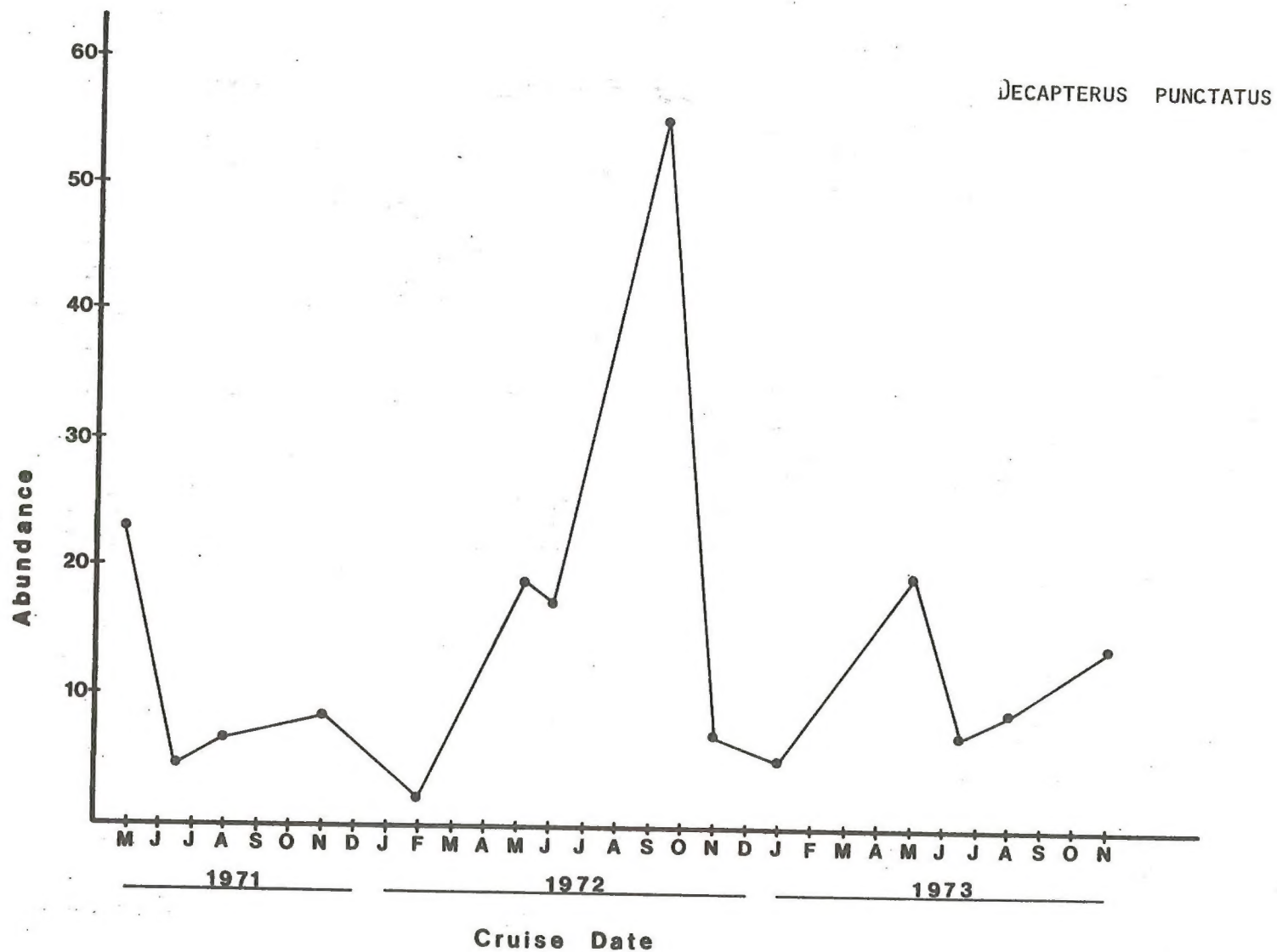


Fig. 95

Estimated mean abundances (number under 10 m² of sea surface) of Decapterus punctatus larvae in the eastern Gulf of Mexico, 1971-1974.

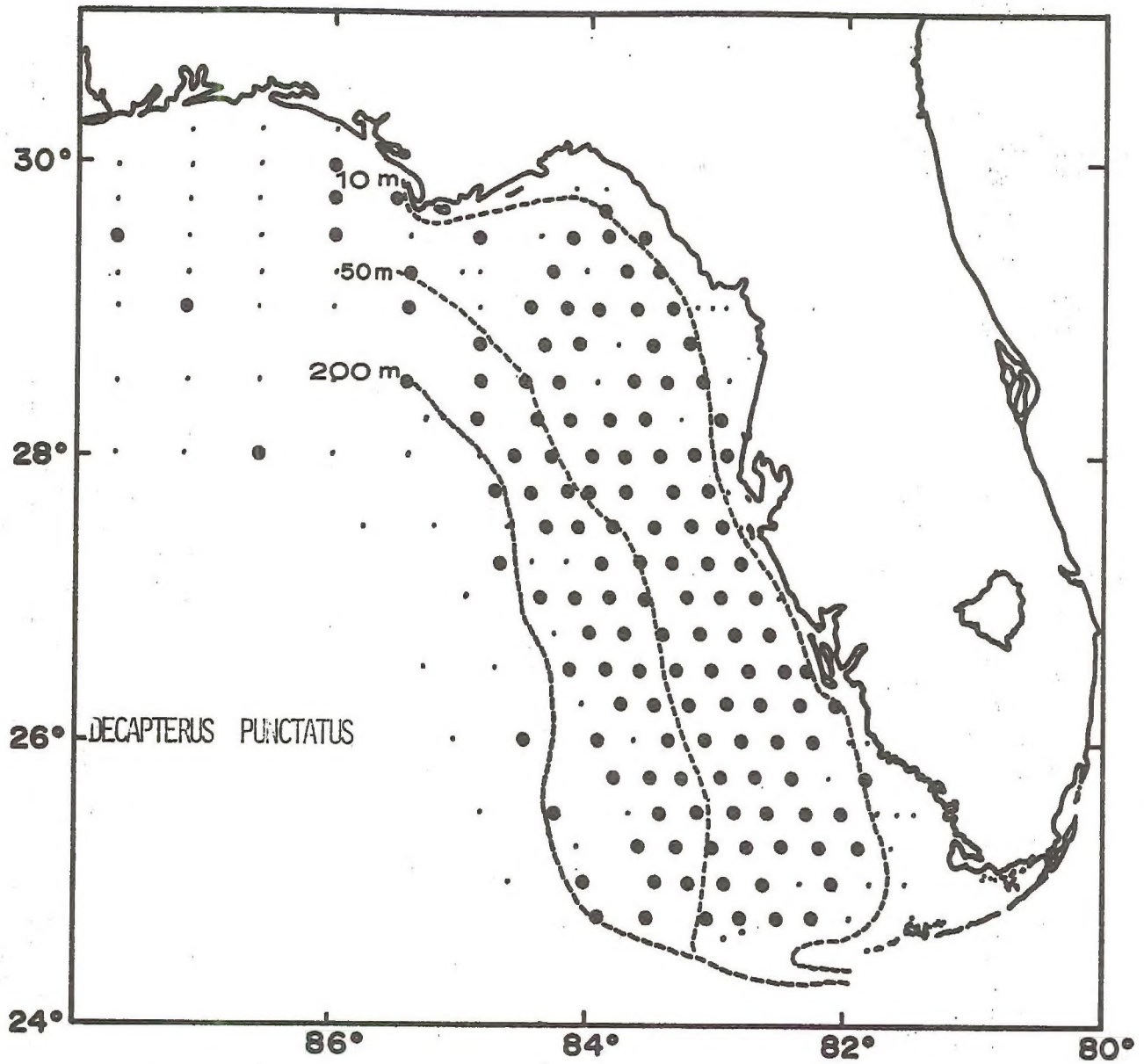


Fig. 96

Stations at which *Decapterus punctatus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

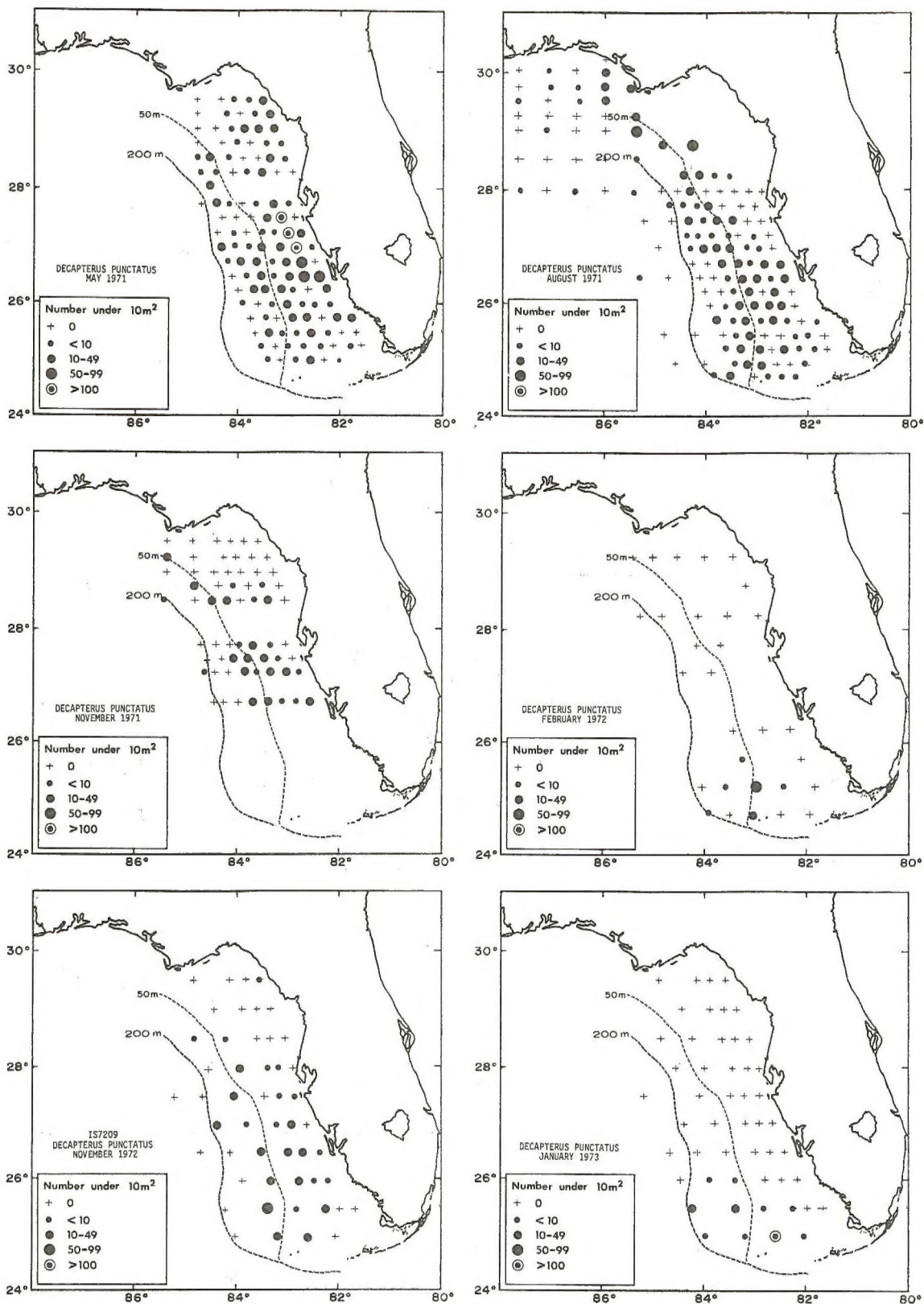


Fig. 97 Distribution and abundance of *Decapterus punctatus* larvae in the eastern Gulf of Mexico, 1971-1974.

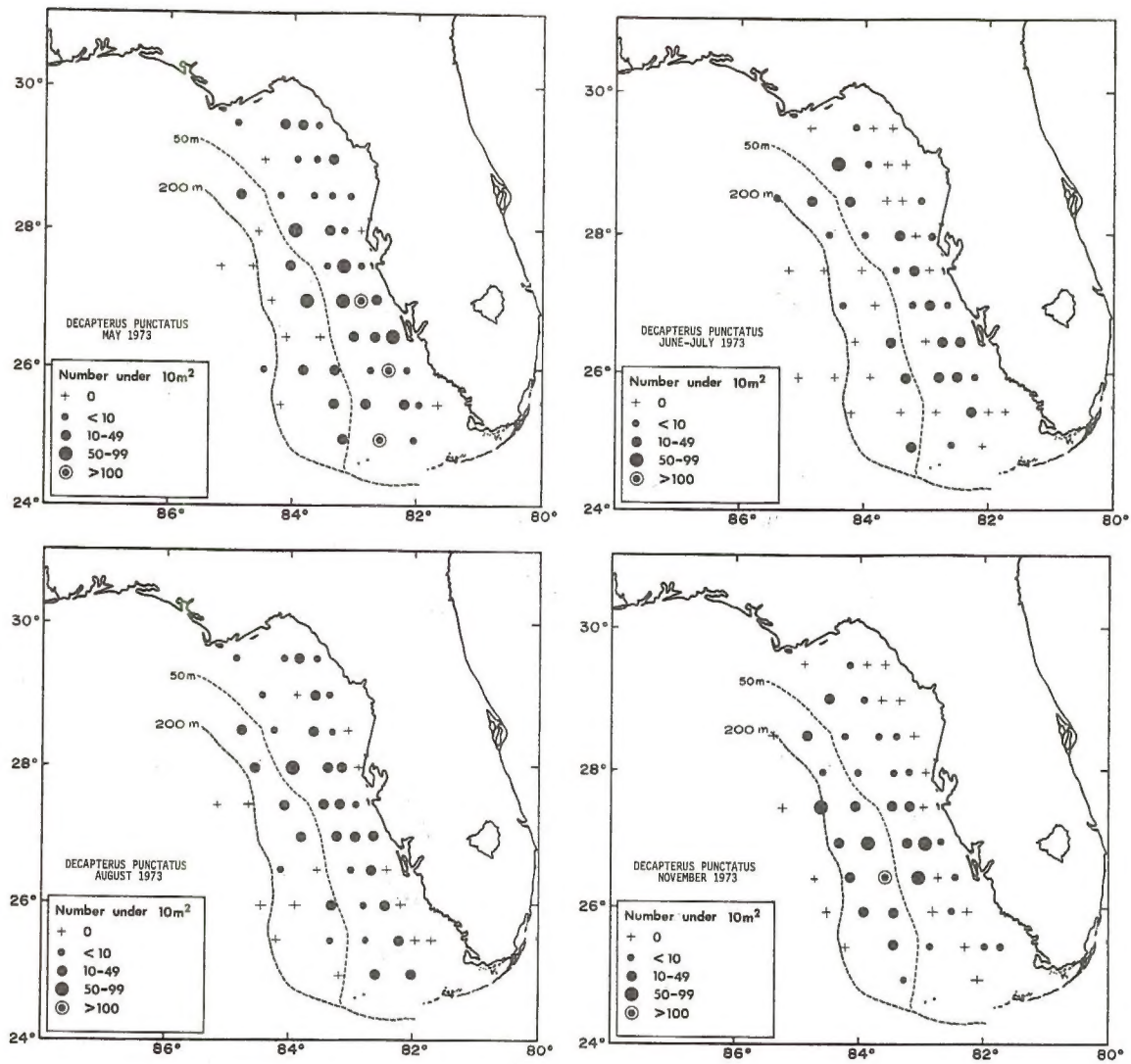


Fig. 97

Cont.

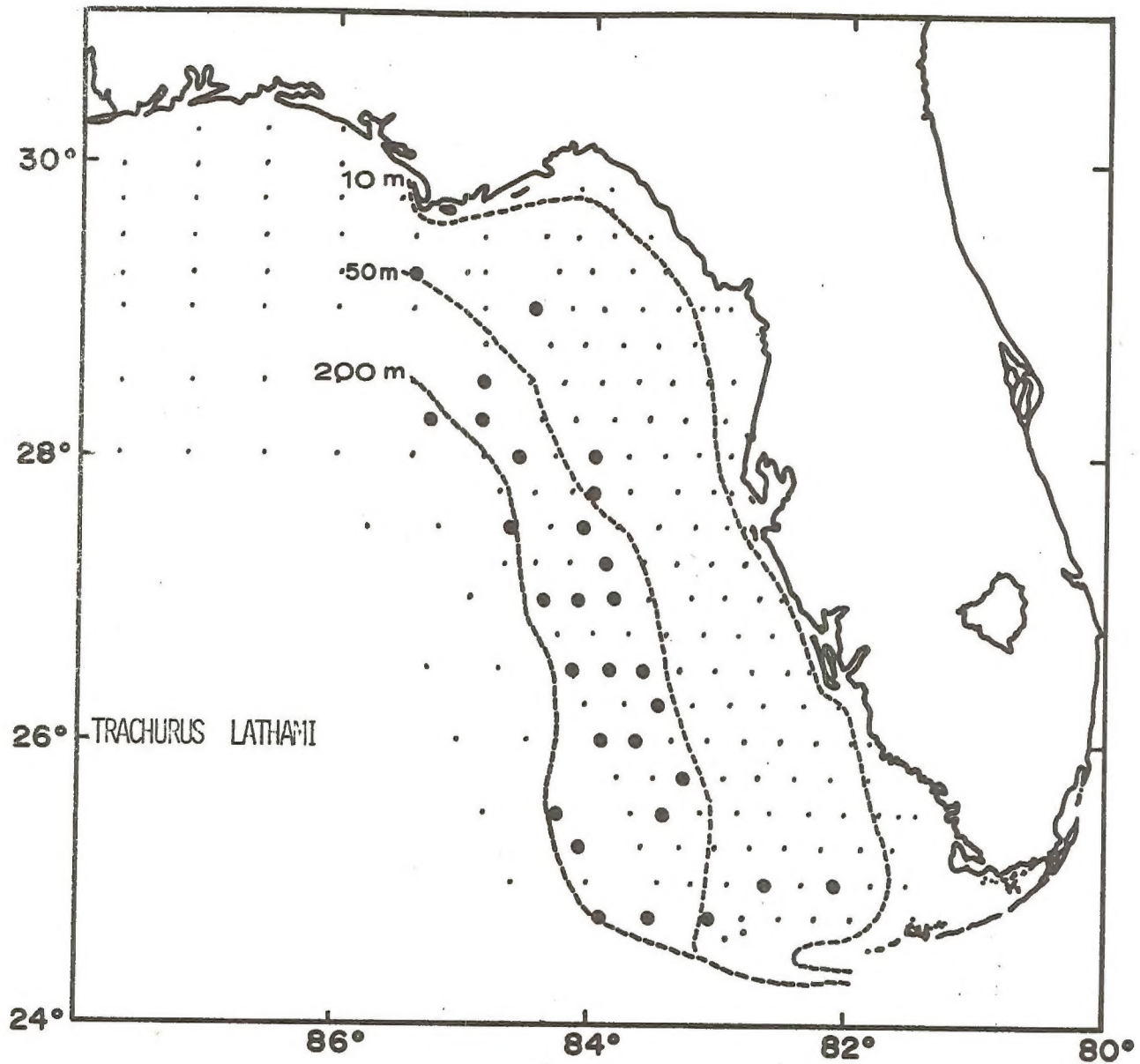


Fig. 98

Stations at which *Trachurus lathami* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

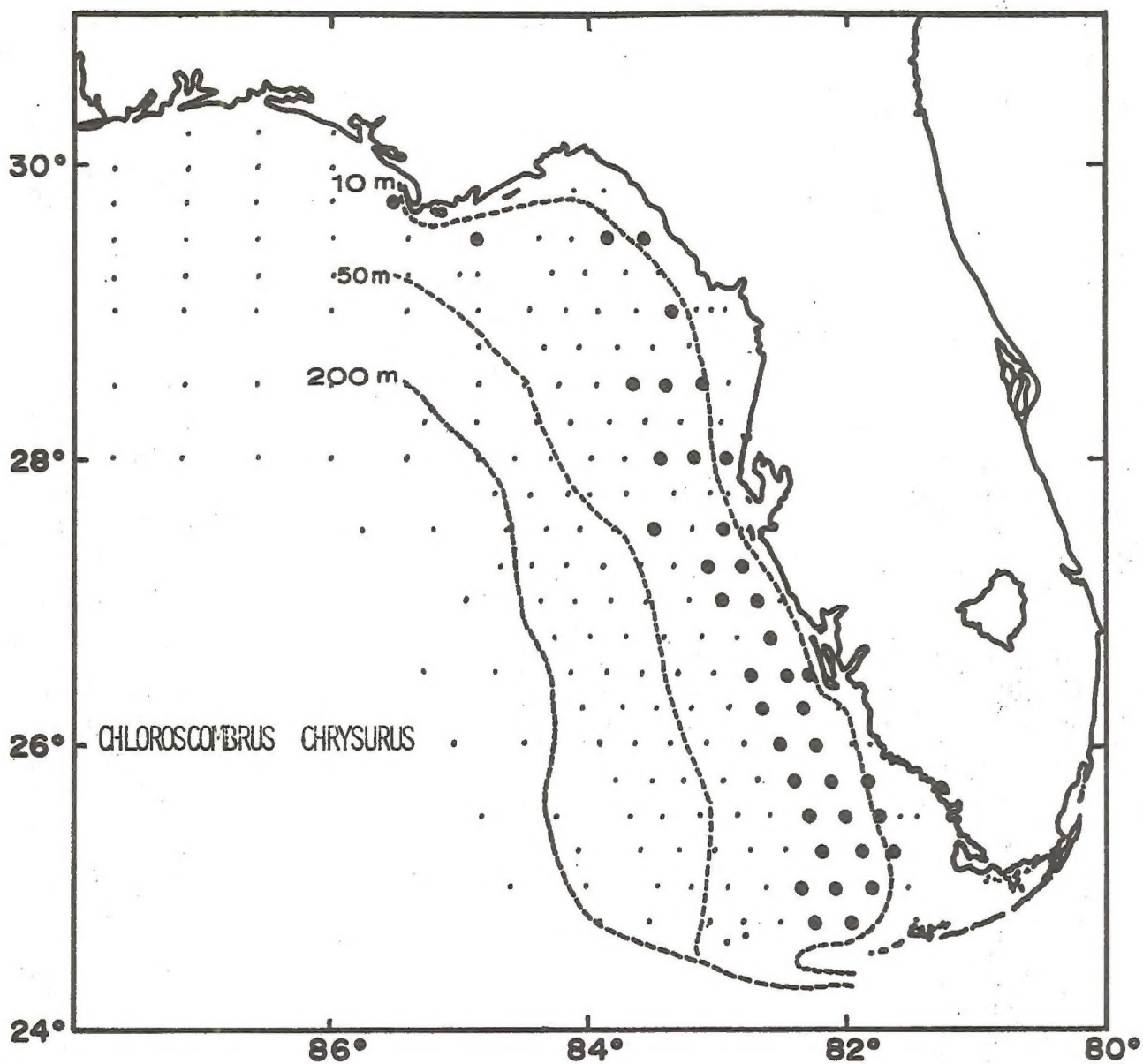


Fig. 99

Stations at which Chloroscombrus chrysurus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

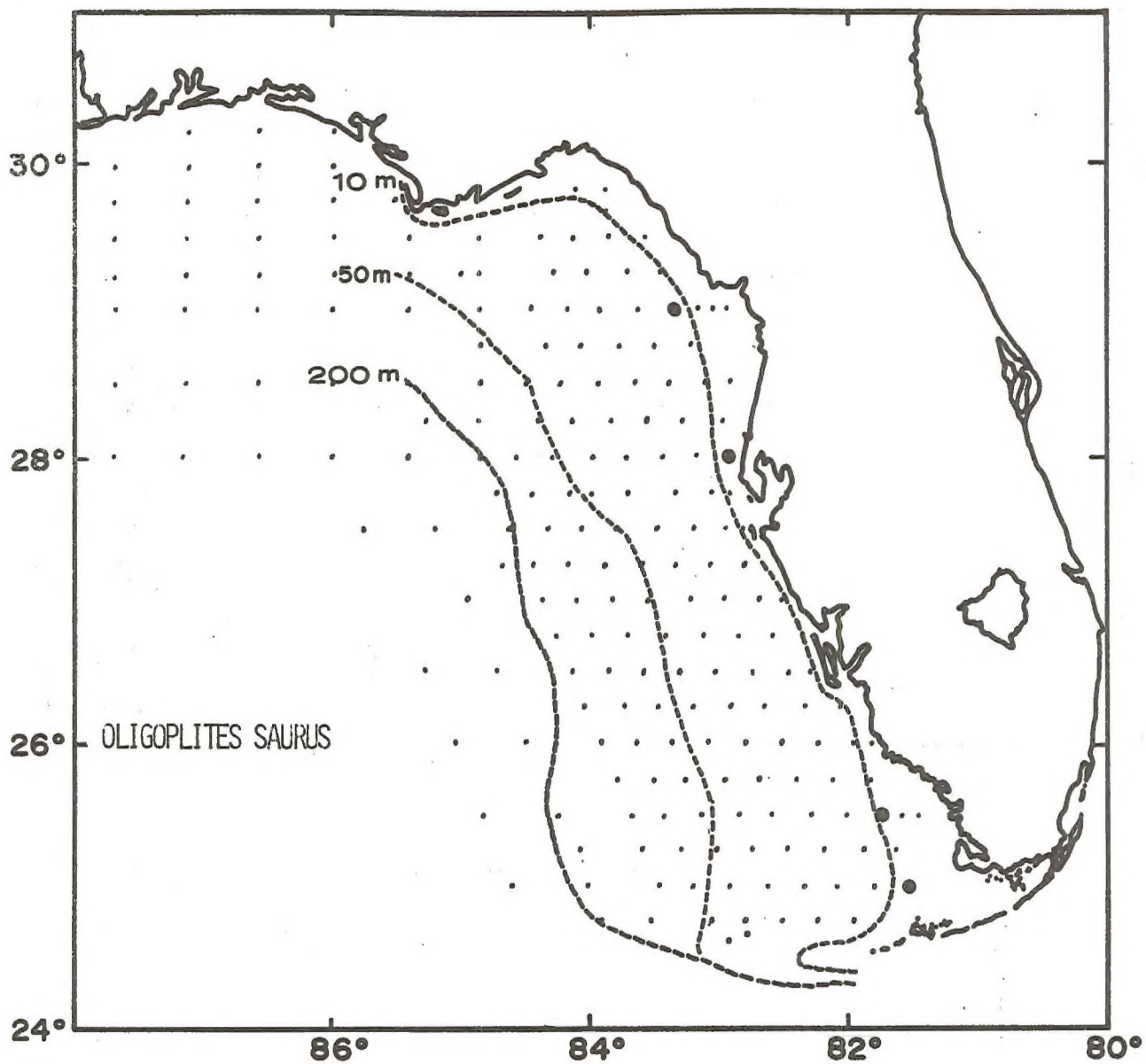


Fig. 100

Stations at which *Oligoplites saurus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

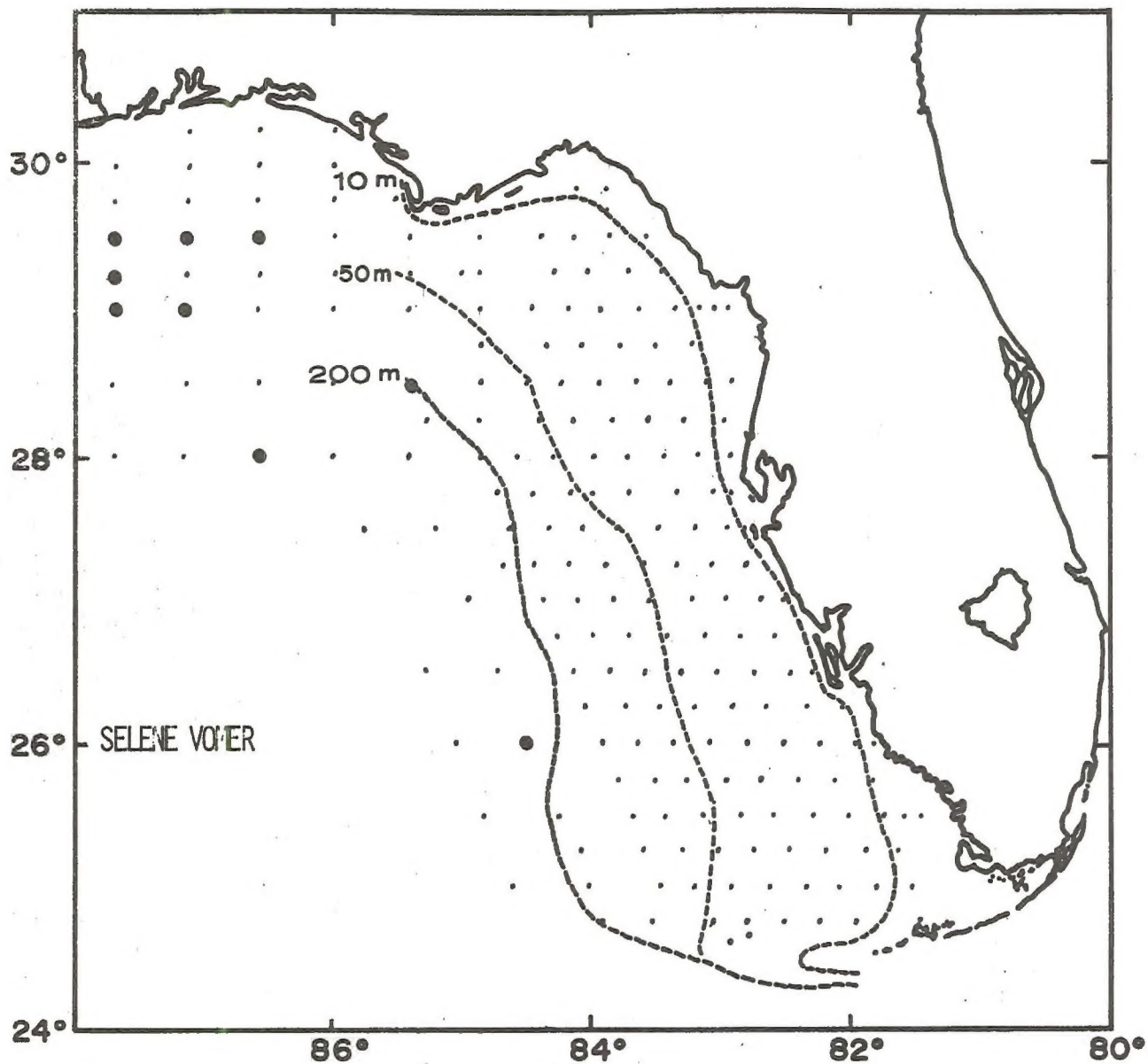


Fig. 101

Stations at which *Selene vomer* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

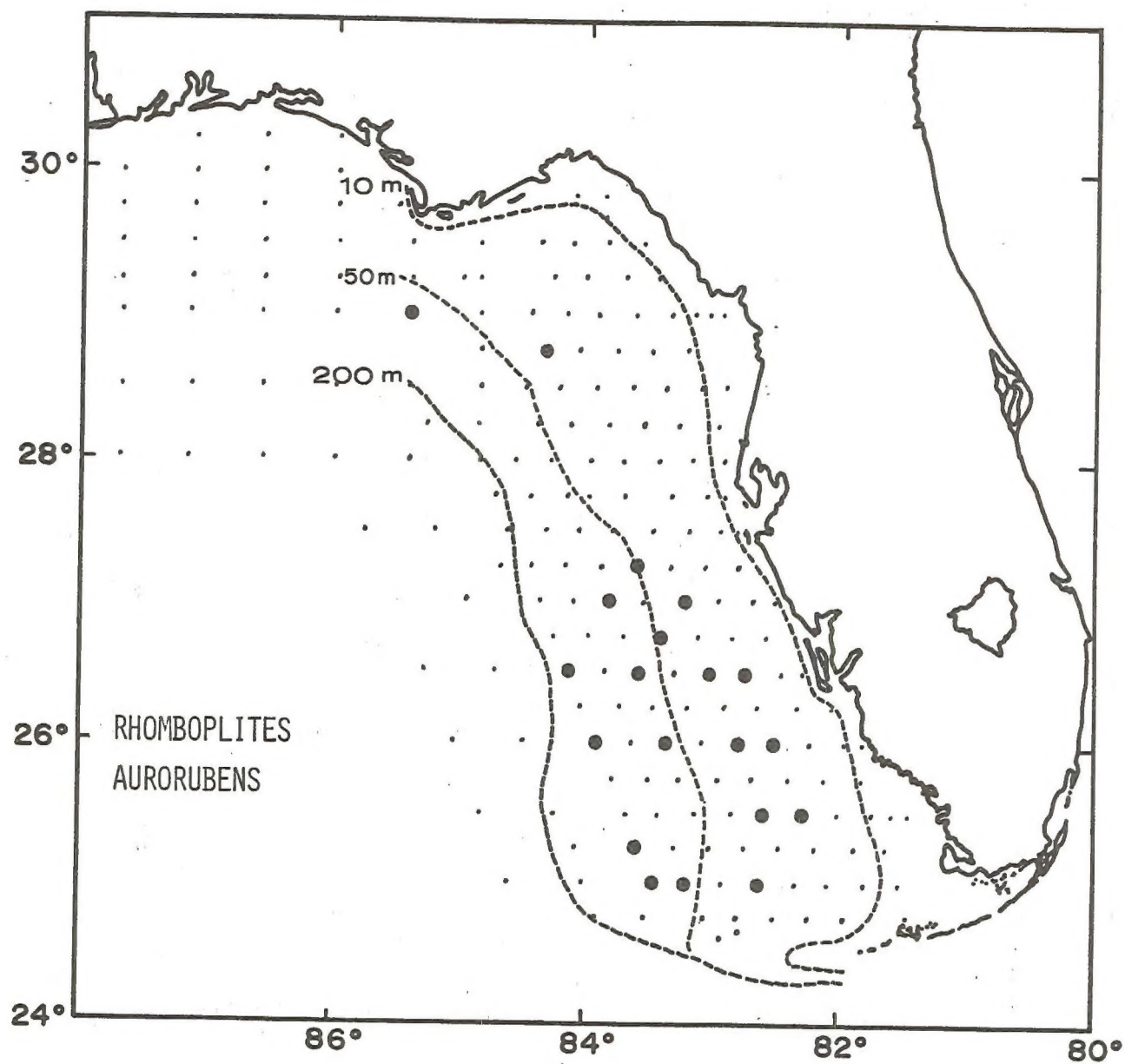


Fig. 102

Stations at which *Rhomboplites aureorubens* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

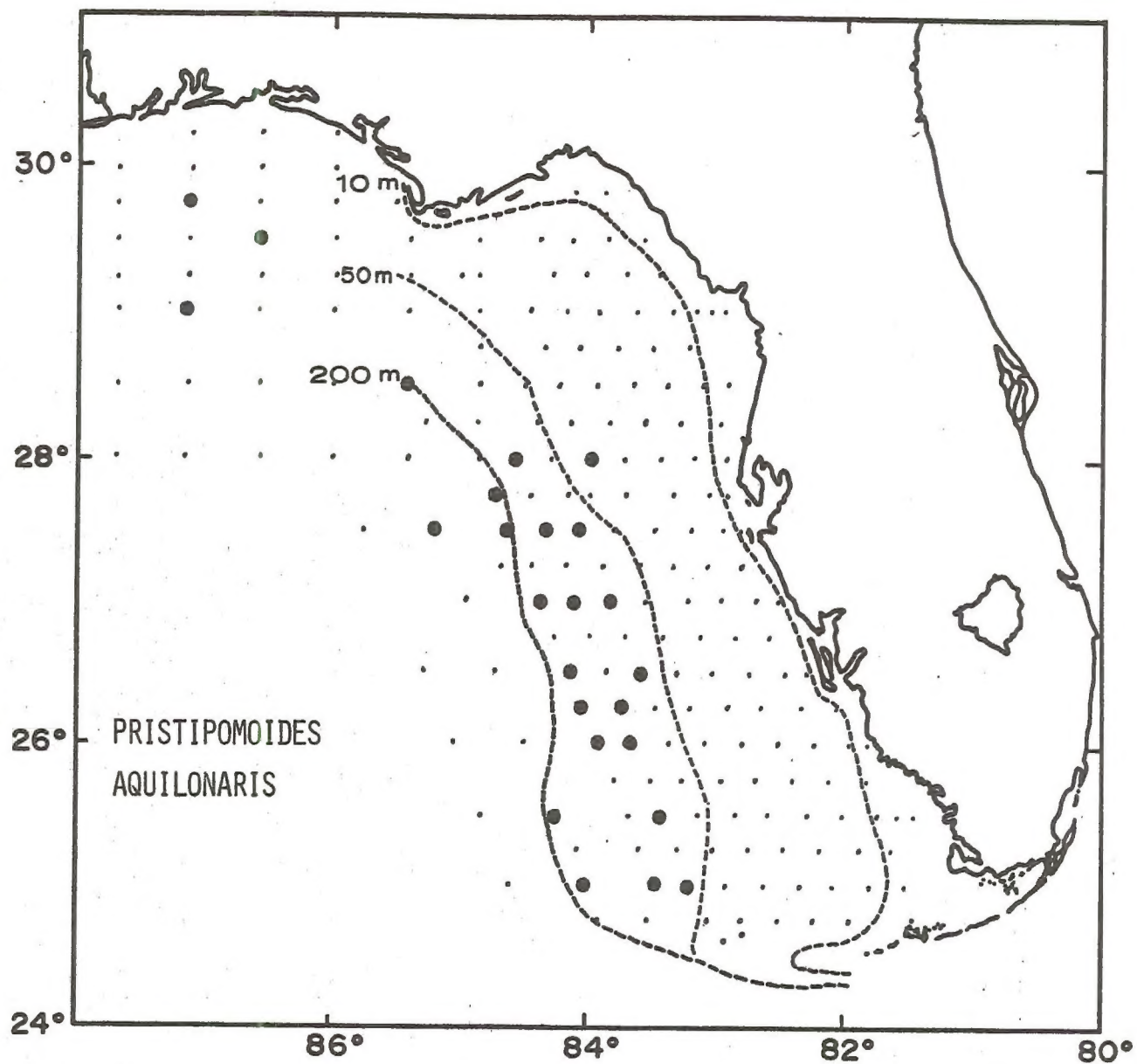


Fig. 103

Stations at which Pristipomoides aquilonaris larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico; 1971-1974.

ORTHOPRISTIS CHRYSOPTERA

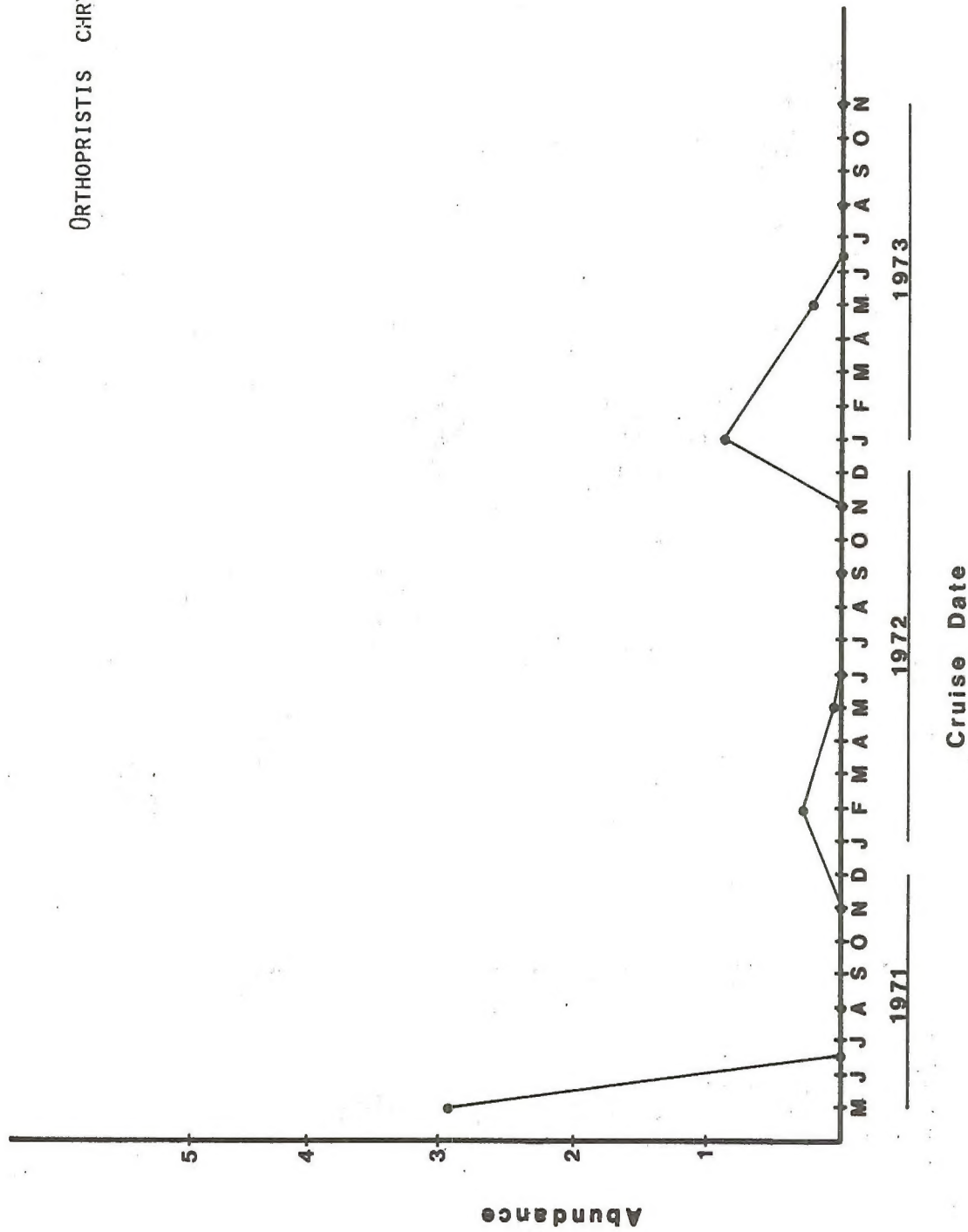


Fig. 104 Estimated mean abundances (number under 10 m² of sea surface) of *Orthopristis chrysoptera* larvae in the eastern Gulf of Mexico, 1971-1974.

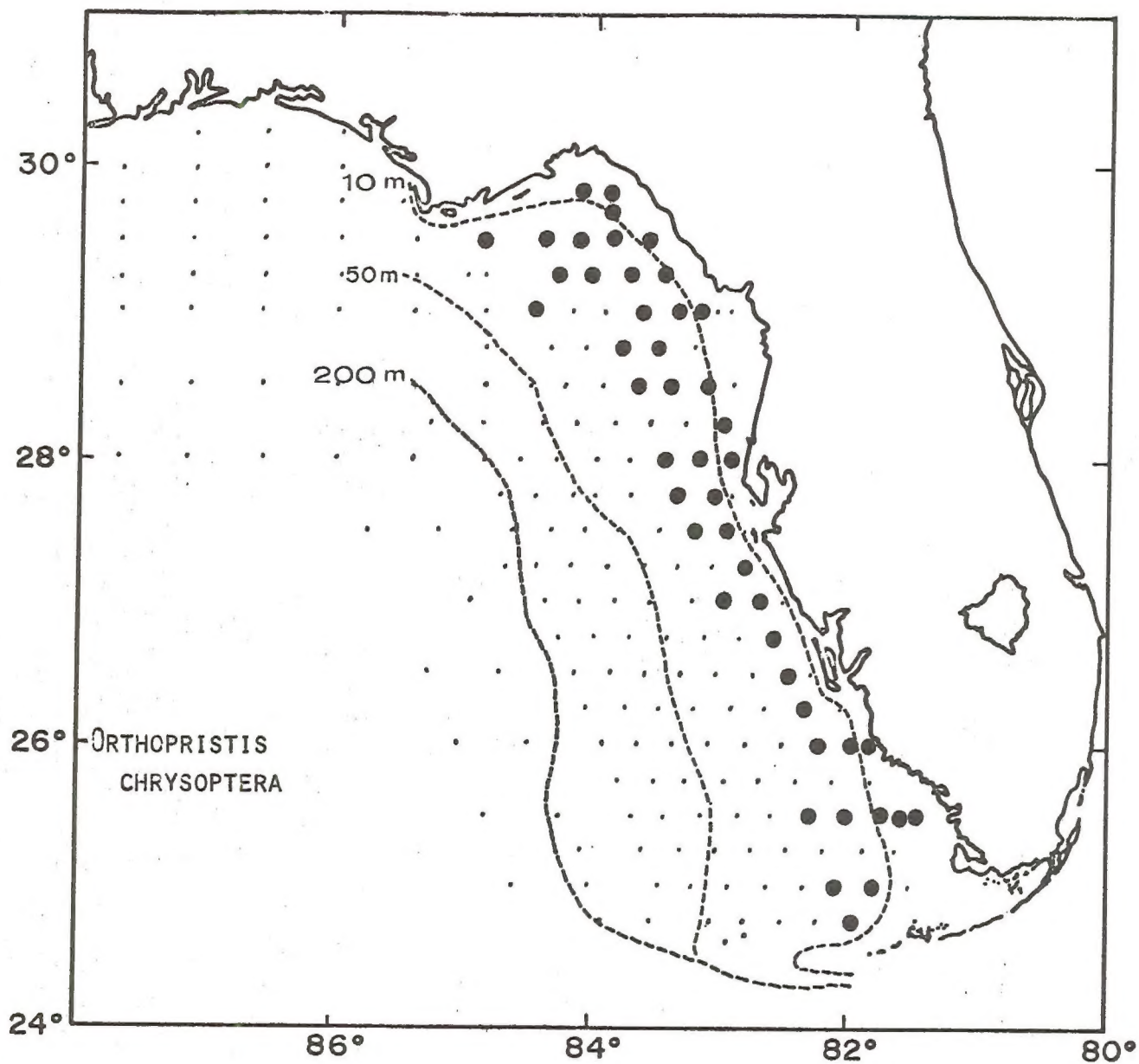


Fig. 105

Stations at which Orthopristis chrysoptera larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

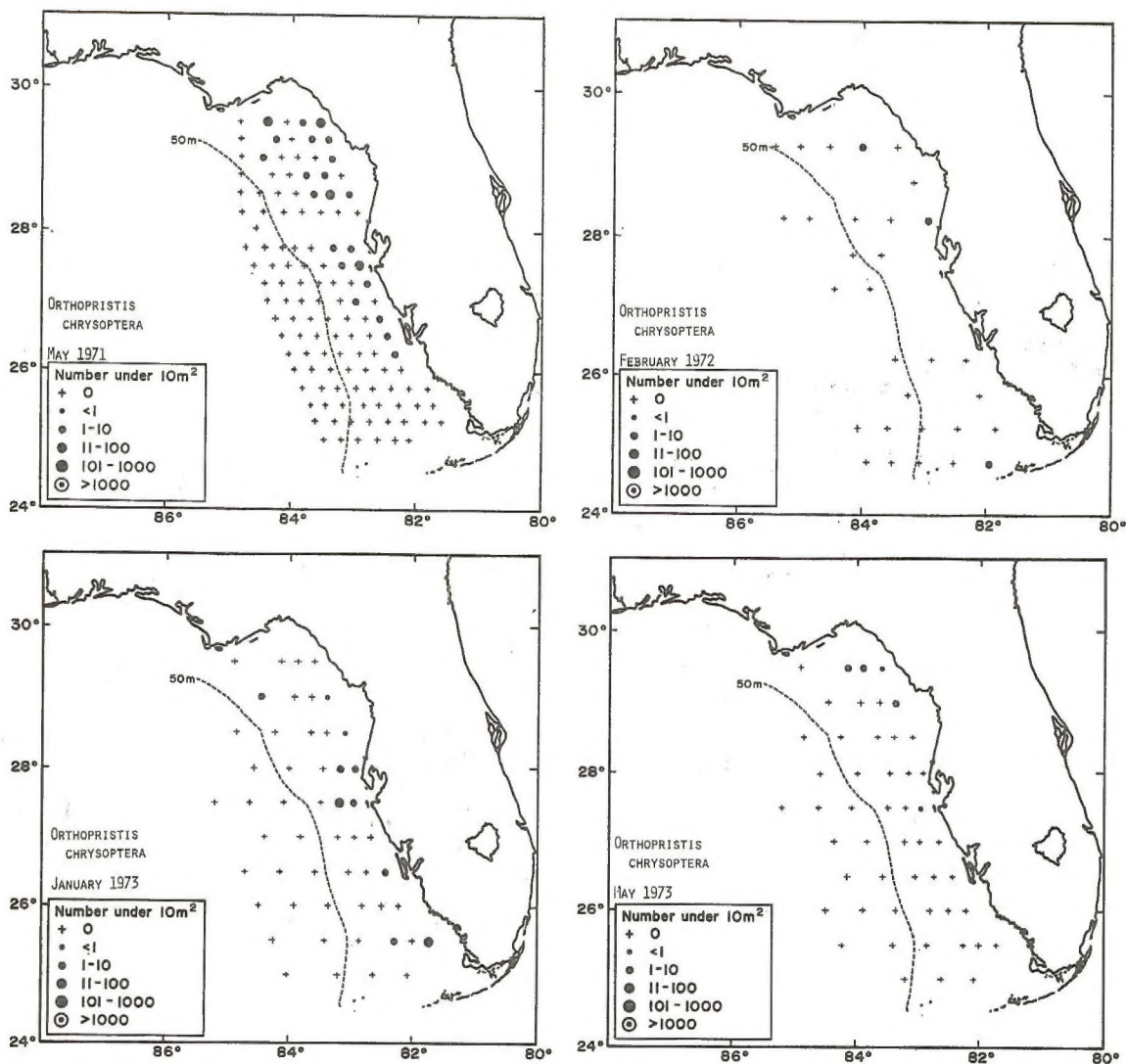


Fig. 106 Distribution and abundance of Orthopristis chrysoptera larvae in the eastern Gulf of Mexico, 1971-1974.

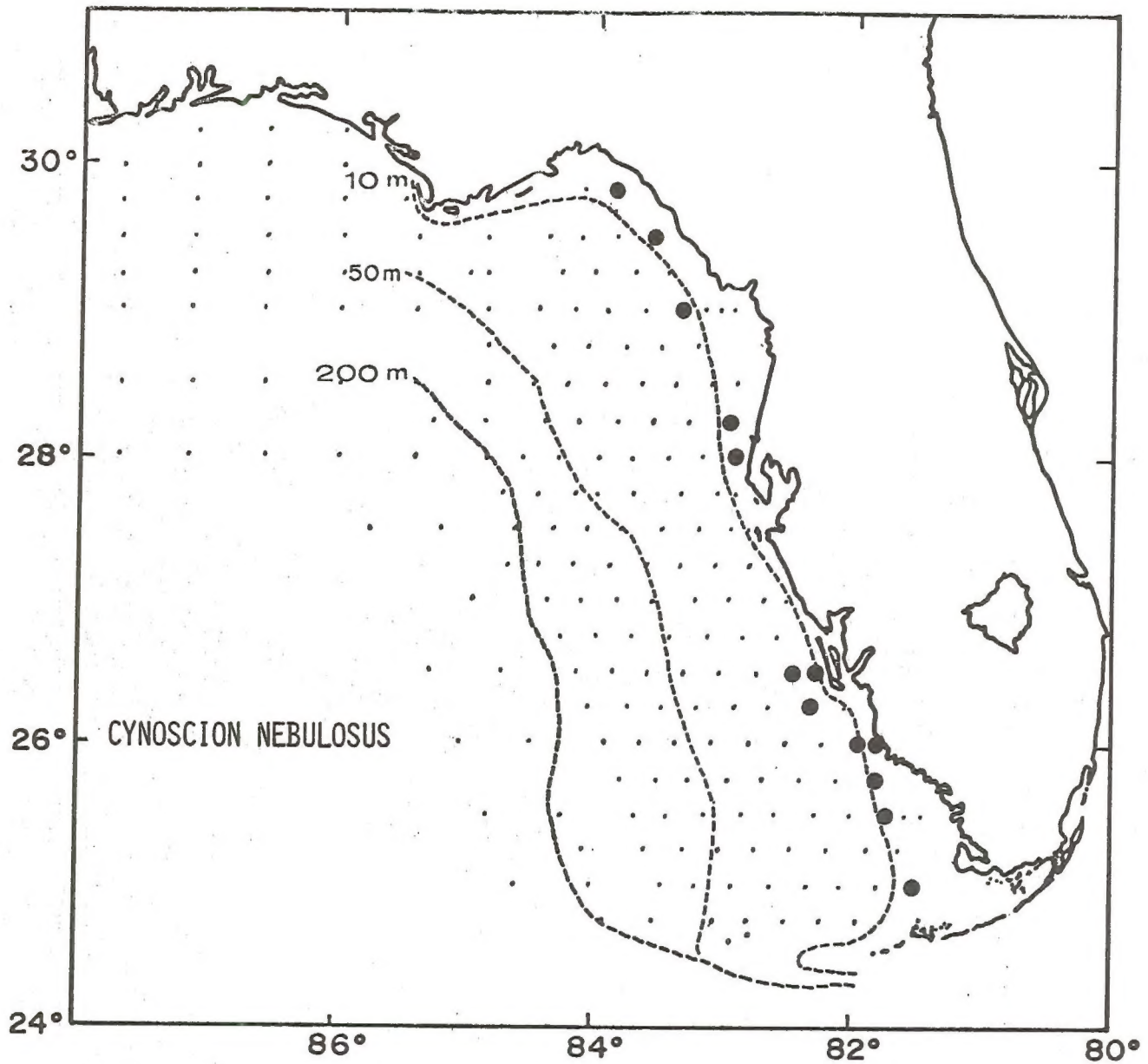


Fig. 107

Stations at which Cynoscion nebulosus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

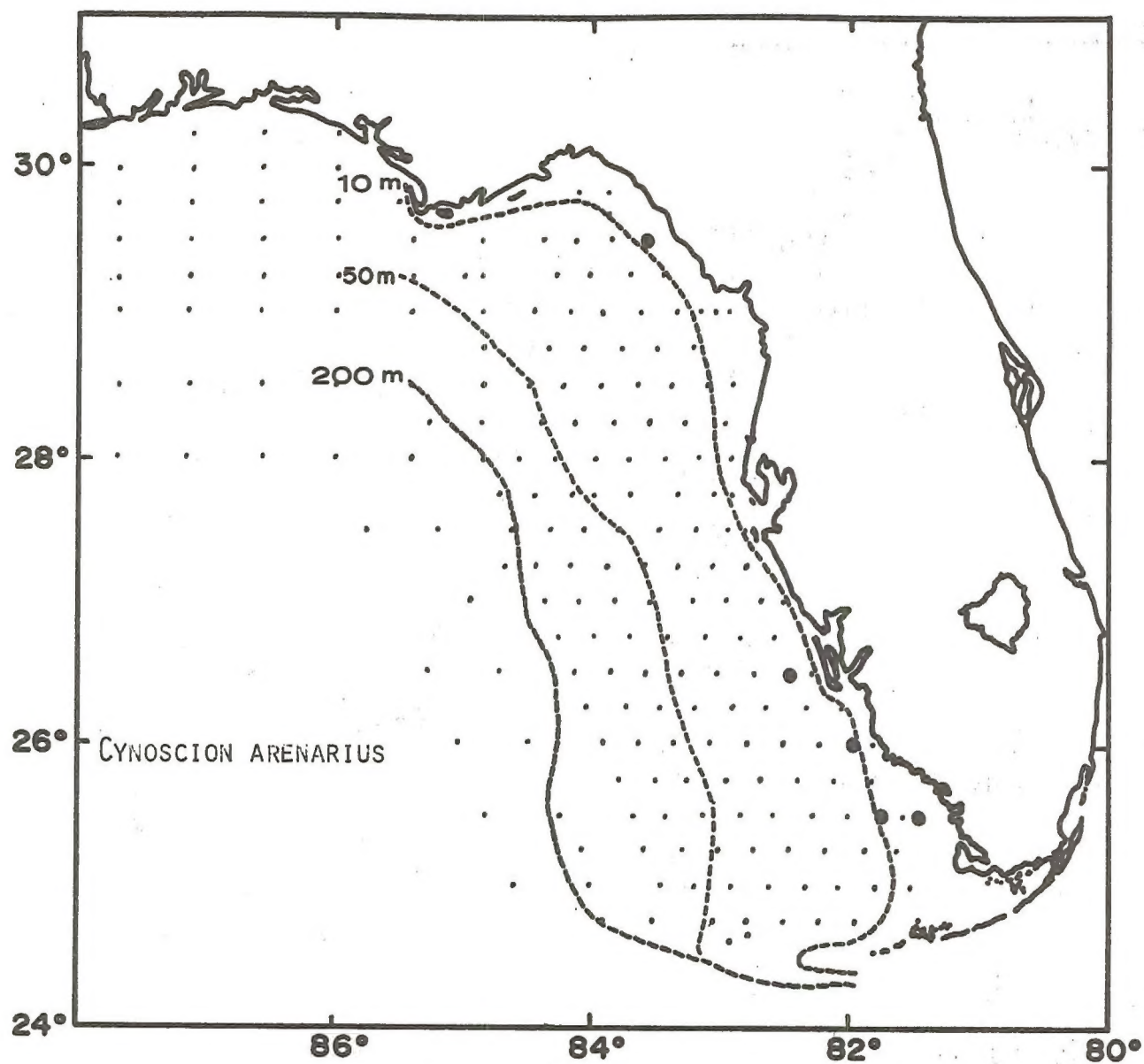


Fig. 108

Stations at which Cynoscion arenarius larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

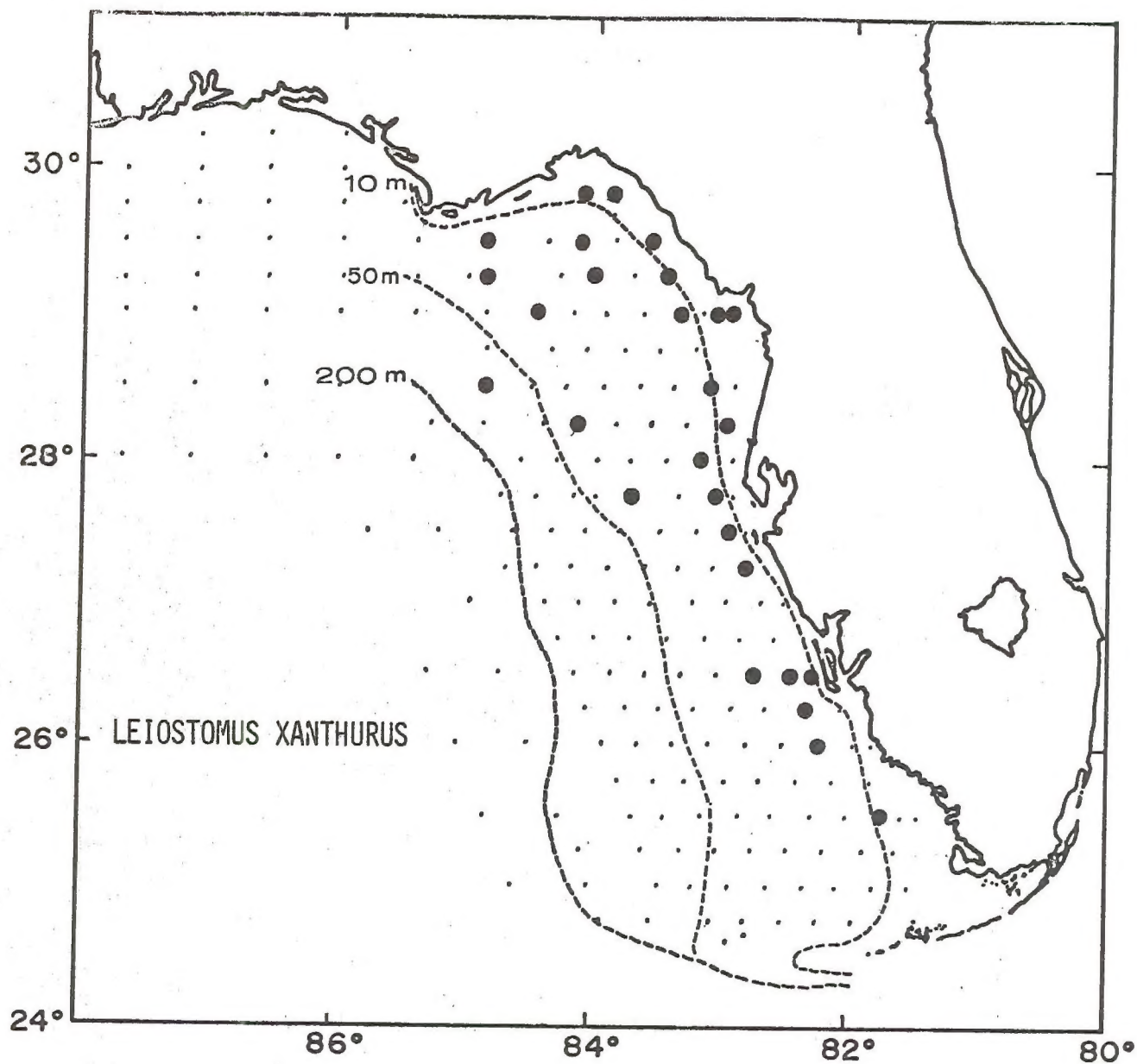


Fig. 109

Stations at which *Leiosomus xanthurus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

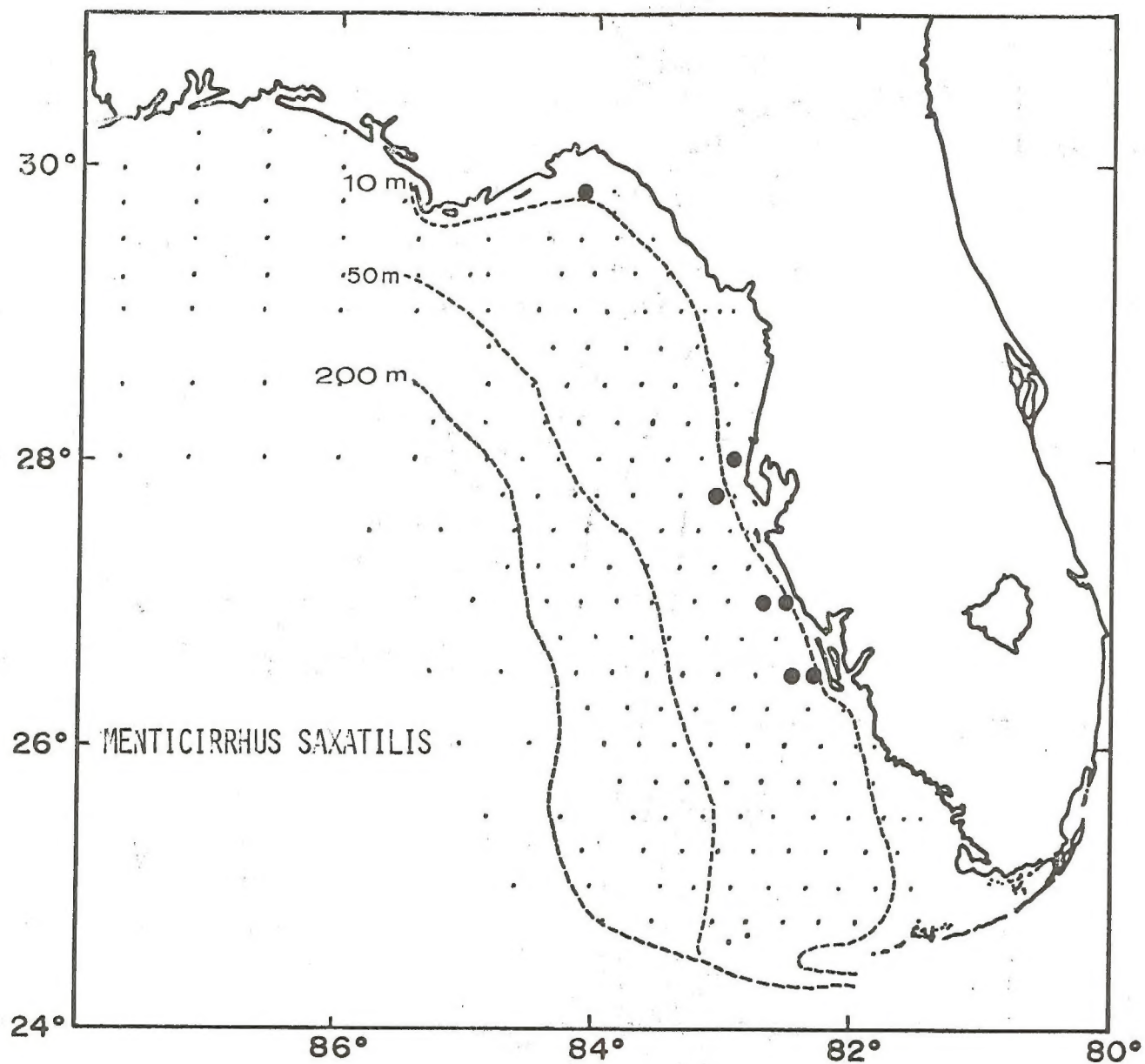


Fig. 110

Stations at which *Menticirrhus saxatilis* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

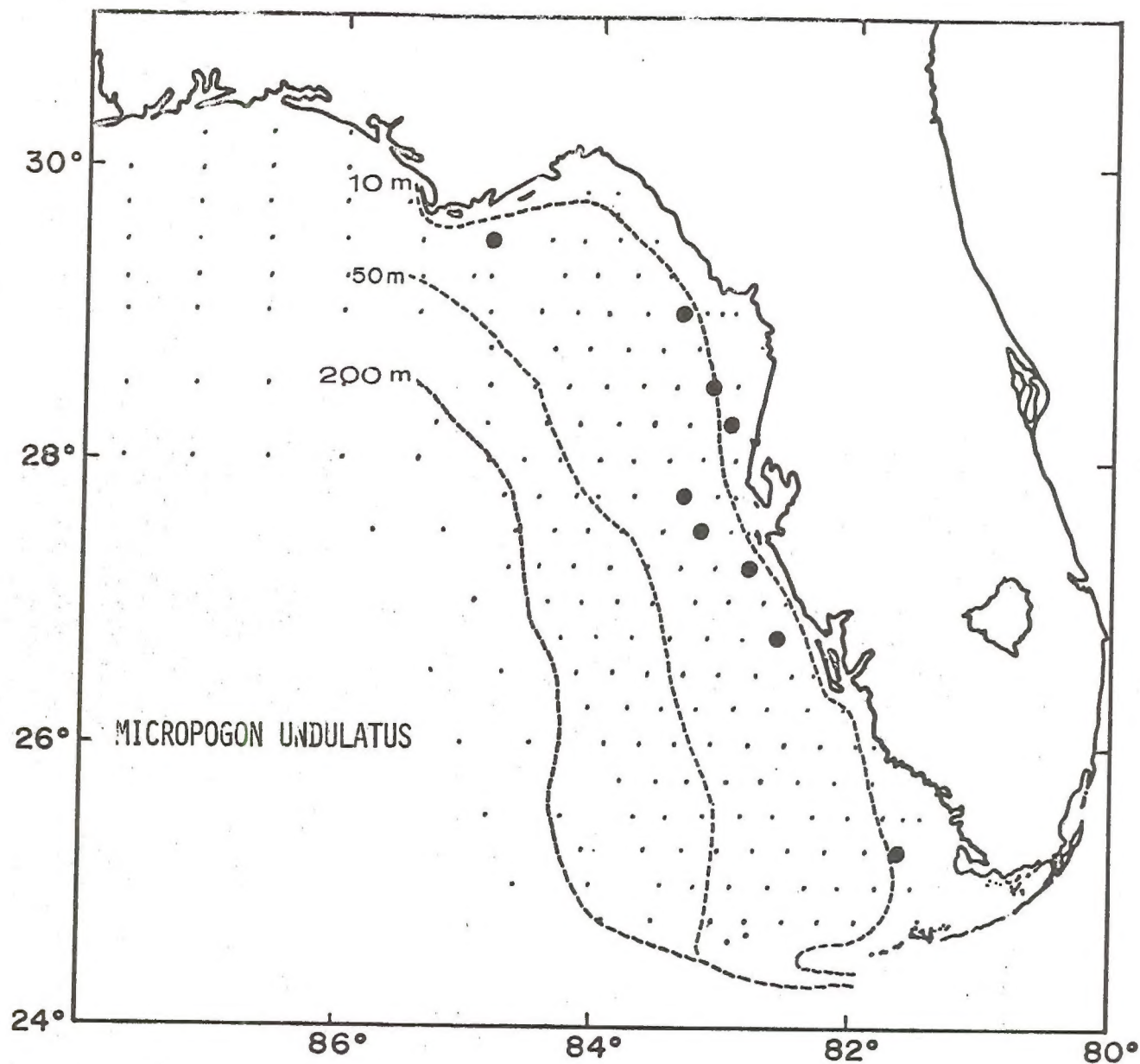


Fig. 111

Stations at which Micropogon undulatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

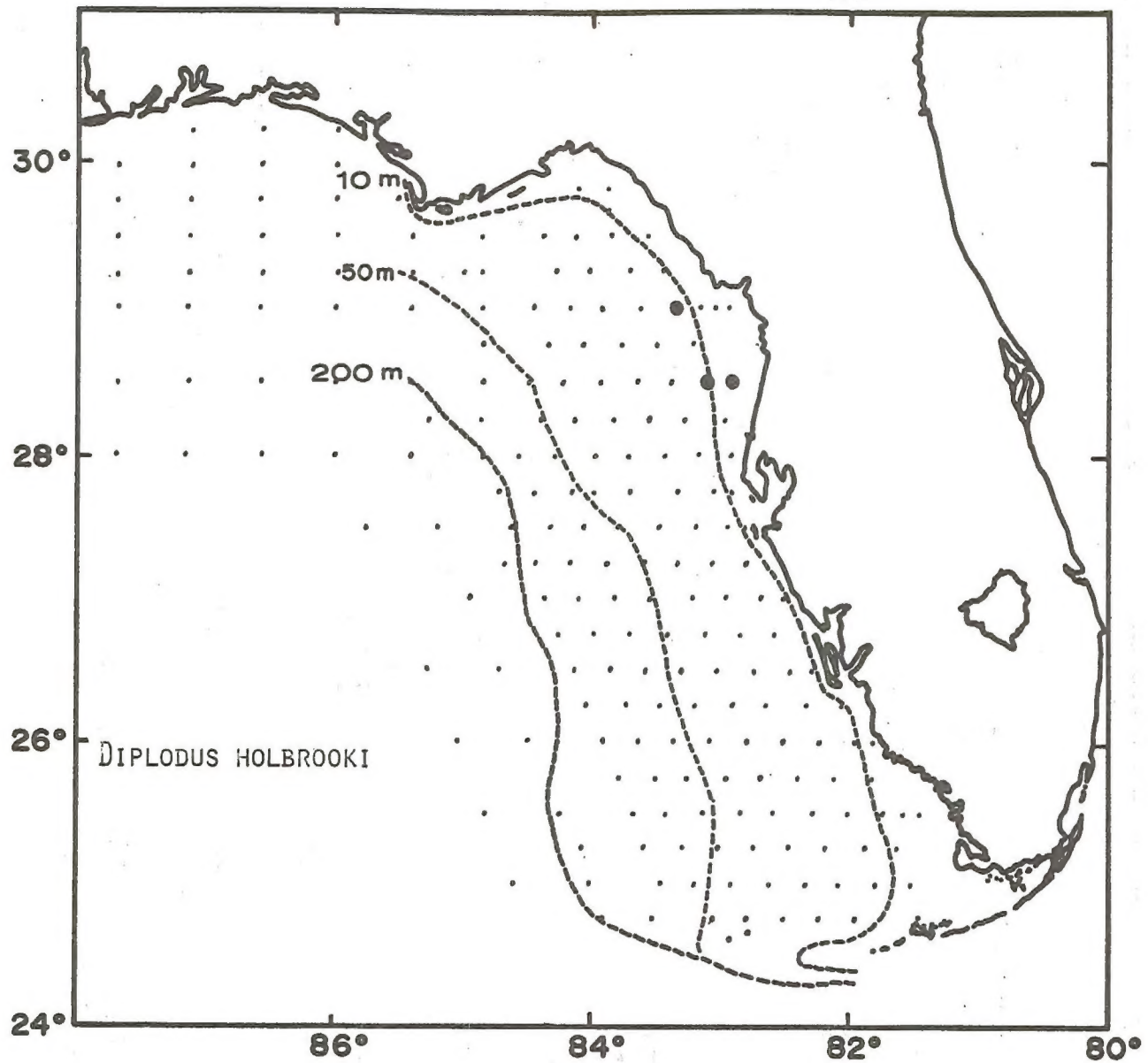


Fig. 112

Stations at which *Diplodus holbrooki* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

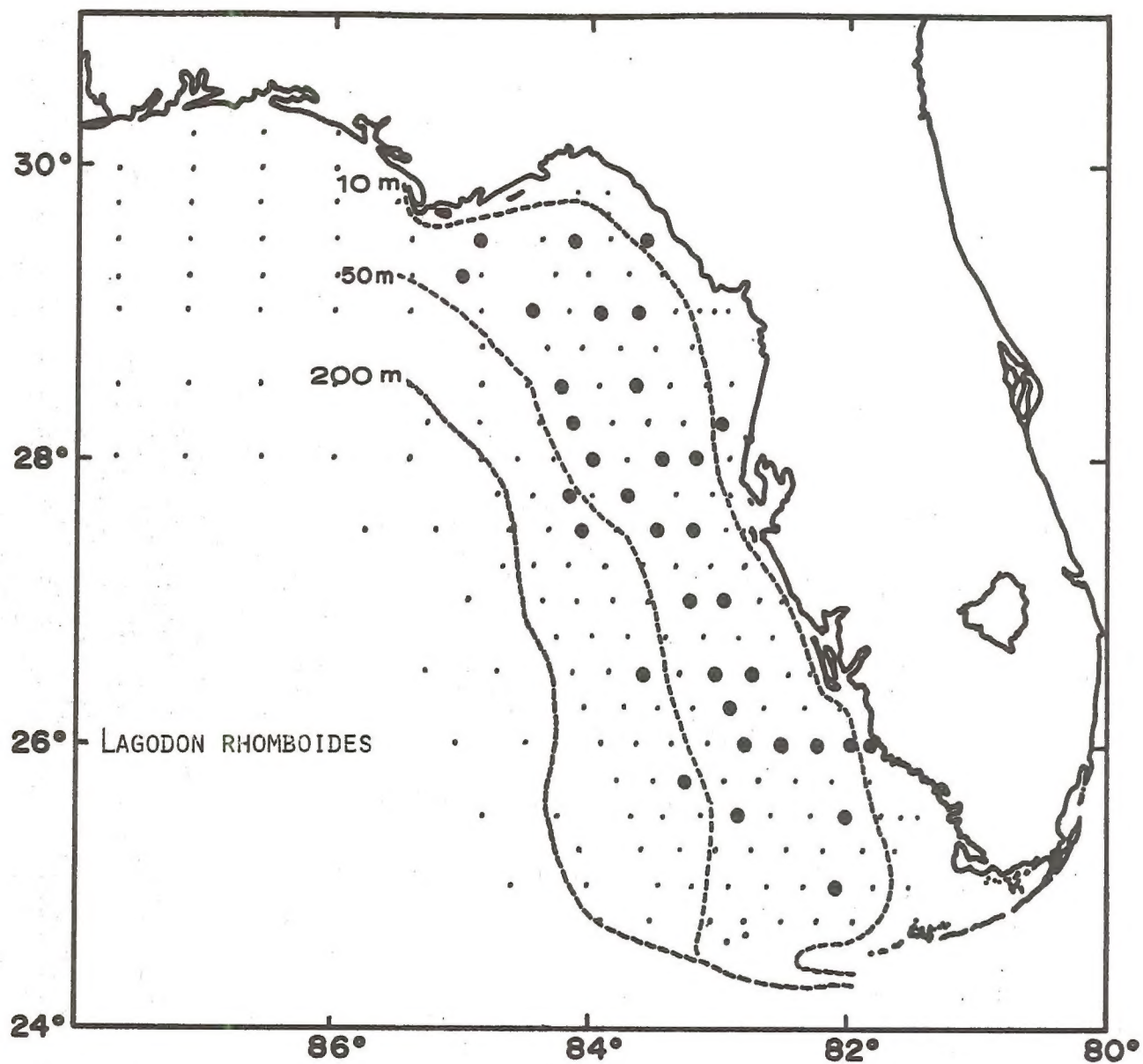


Fig. 113

Stations at which *Lagodon rhomboides* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

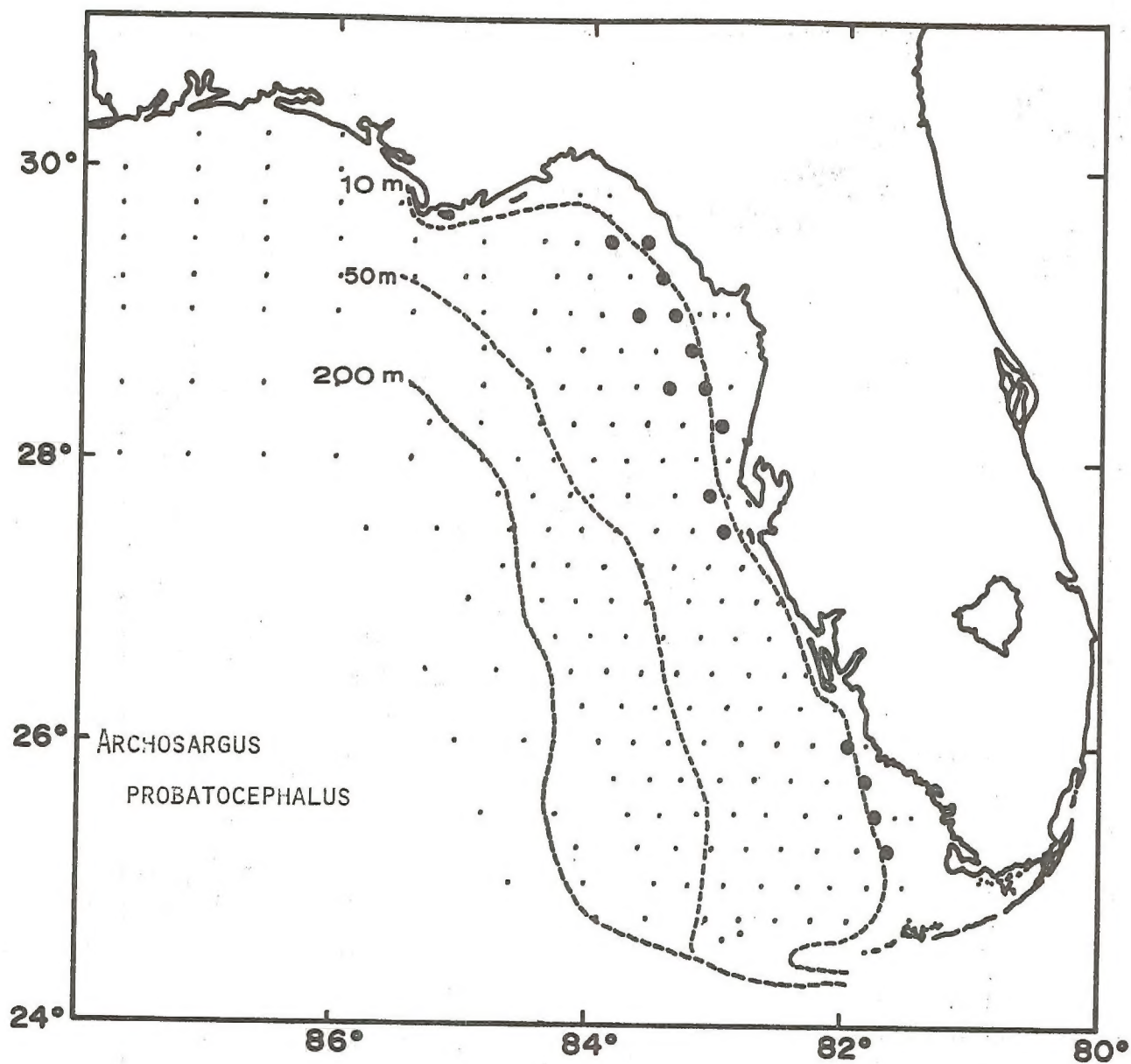


Fig. 114

Stations at which Archosargus probatocephalus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

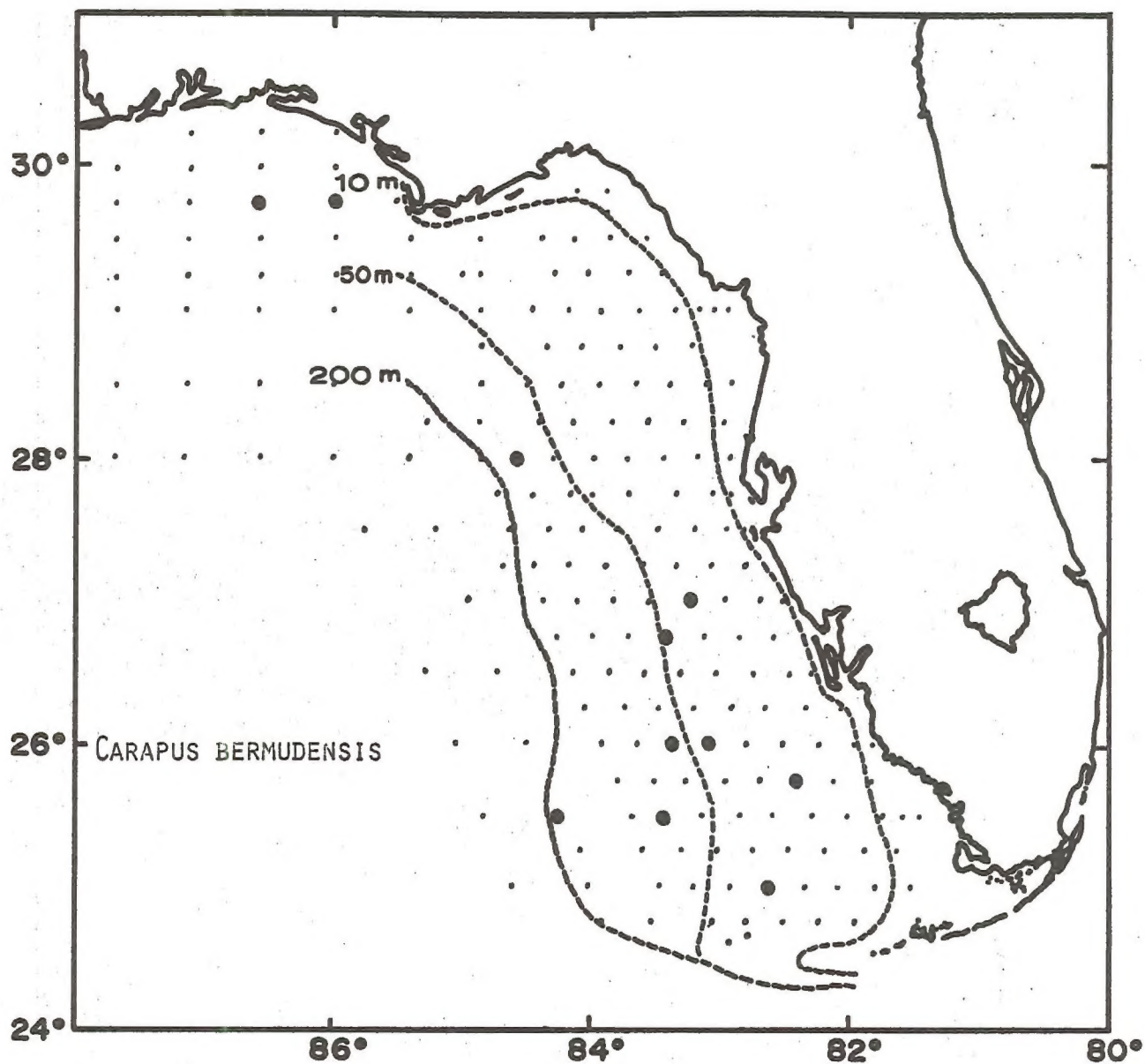


Fig. 115

Stations at which *Carapus bermudensis* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

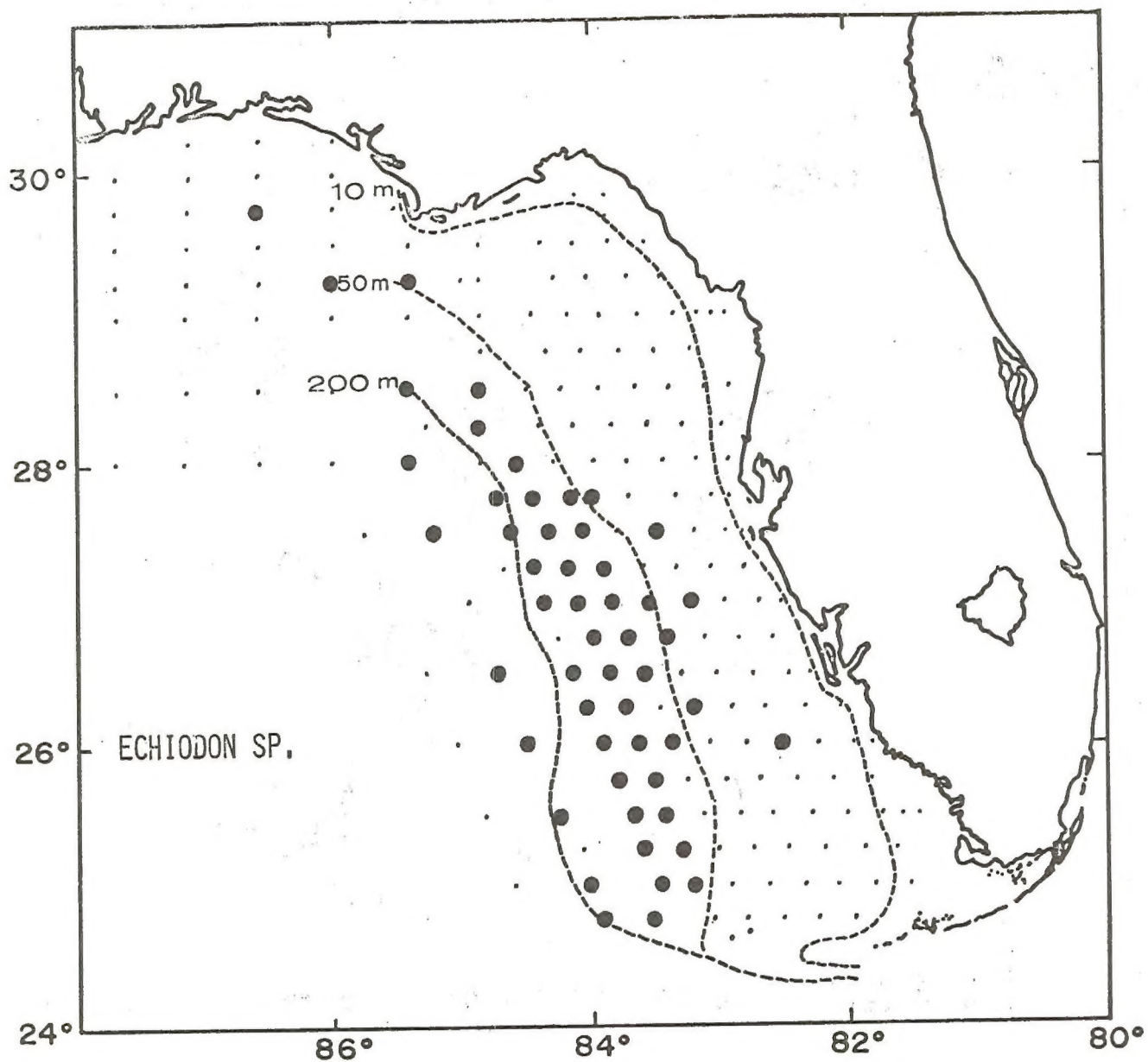
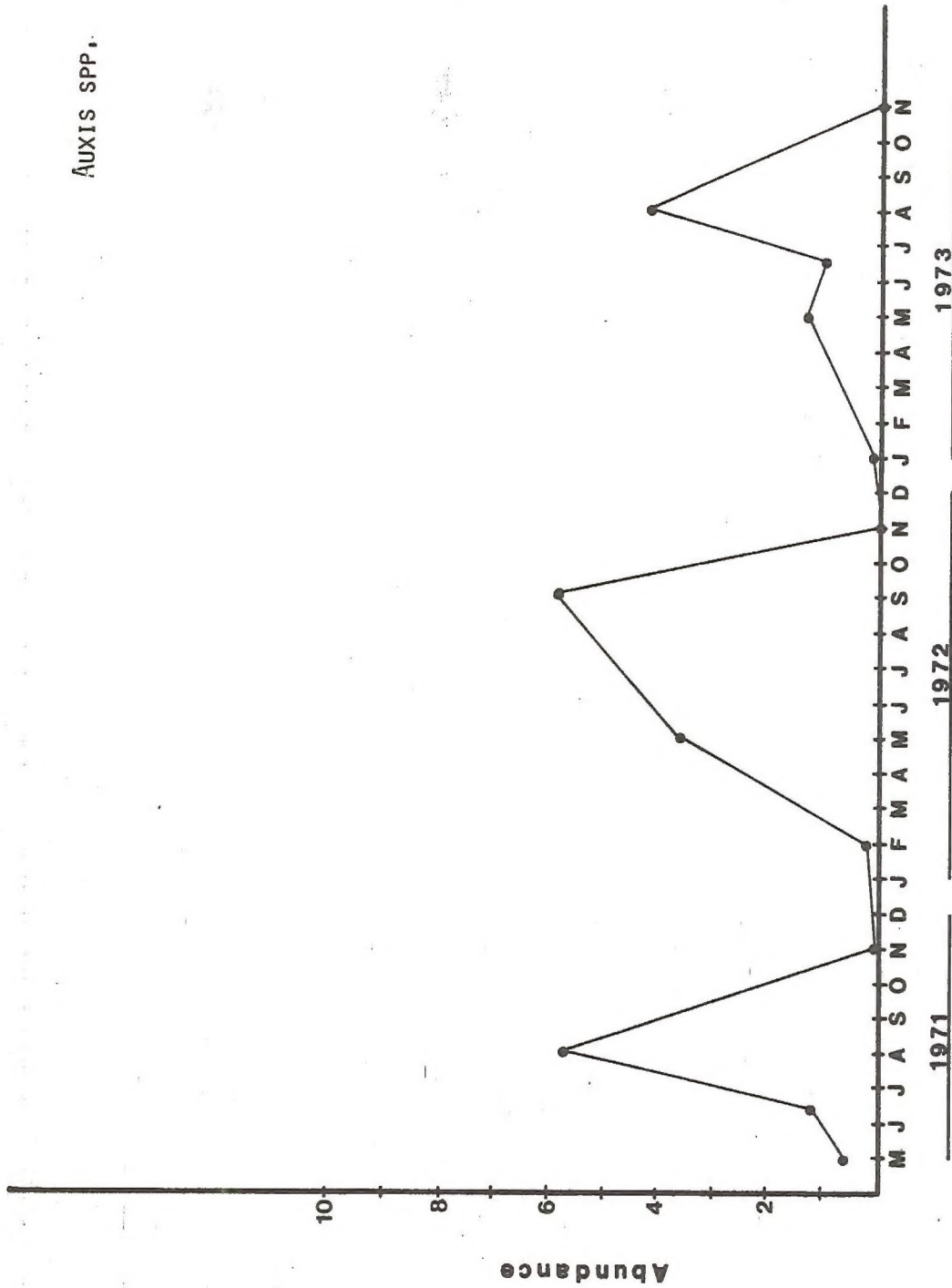


Fig. 116

Stations at which *Echiodon* sp. larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

AUXIS spp.



Cruise Date

Fig. 117 Estimated mean abundances (number under 10 m² of sea surface) of *Auxis* sp. larvae in the eastern Gulf of Mexico, 1971-1974.

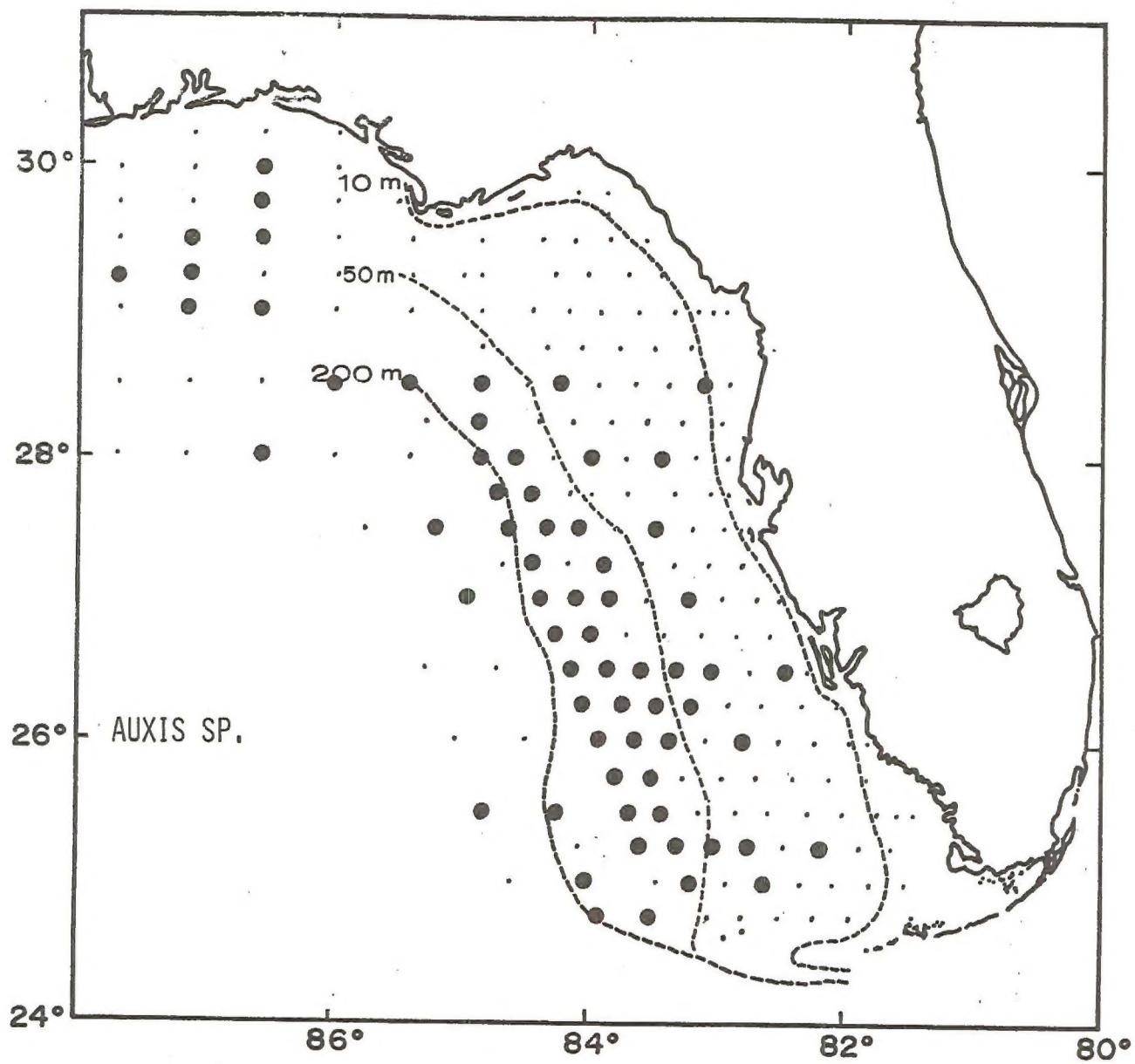


Fig. 118

Stations at which *Auxis* sp. larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

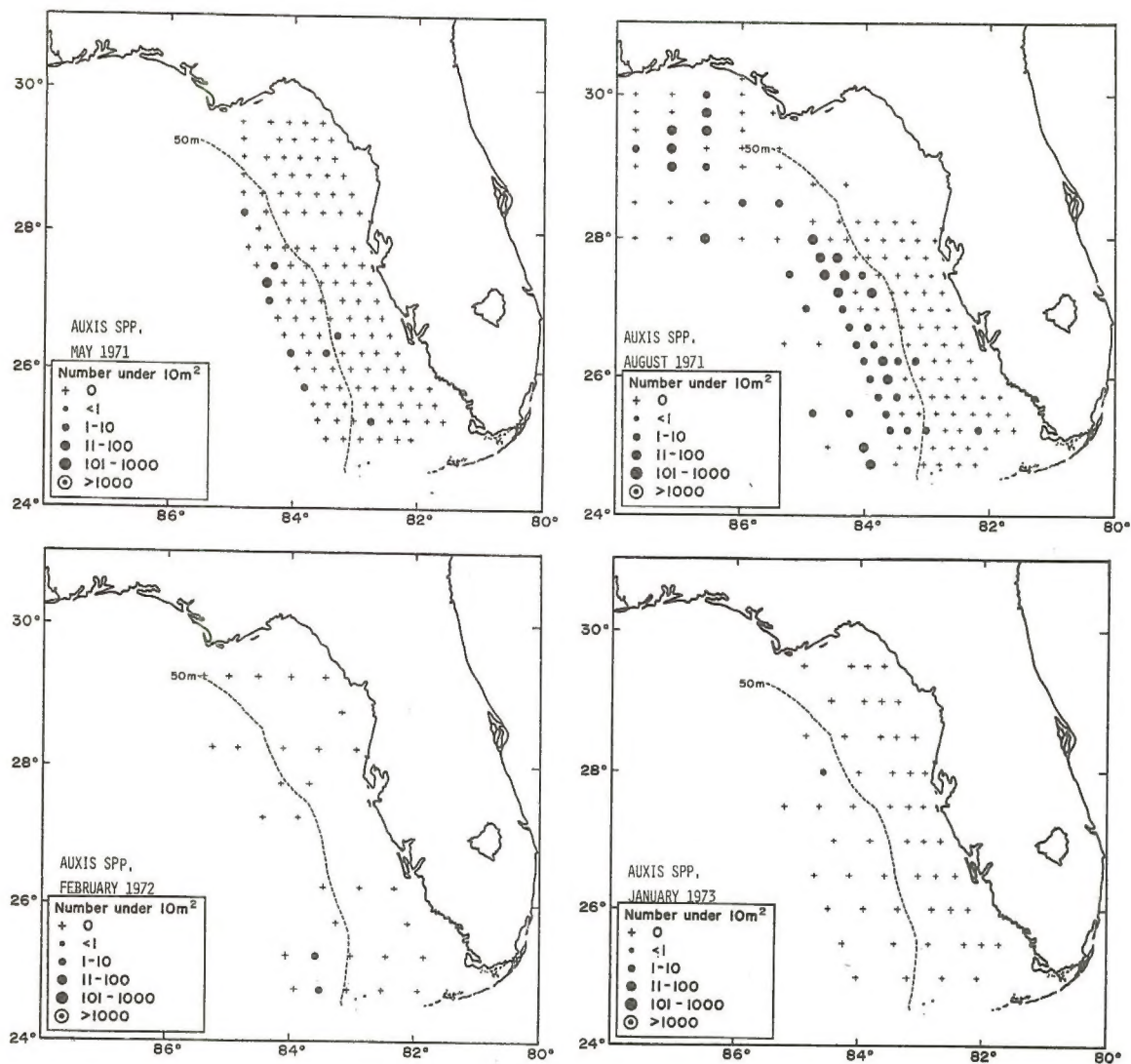


Fig. 119 Distribution and abundance of *Auxis* sp. larvae in the eastern Gulf of Mexico, 1971-1974.

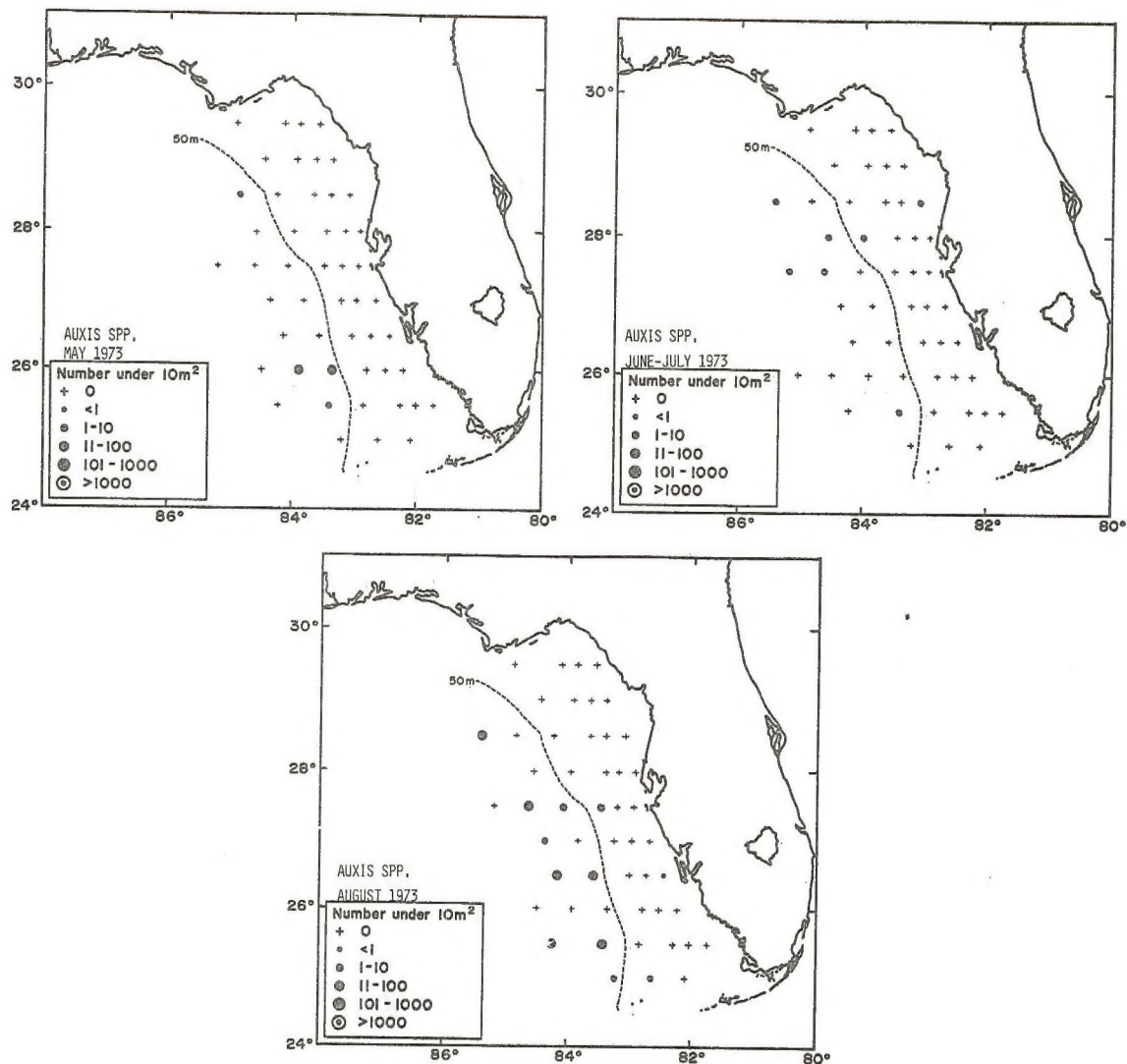


Fig. 119

Cont.

EUTHYNNUS ALLETTERATUS

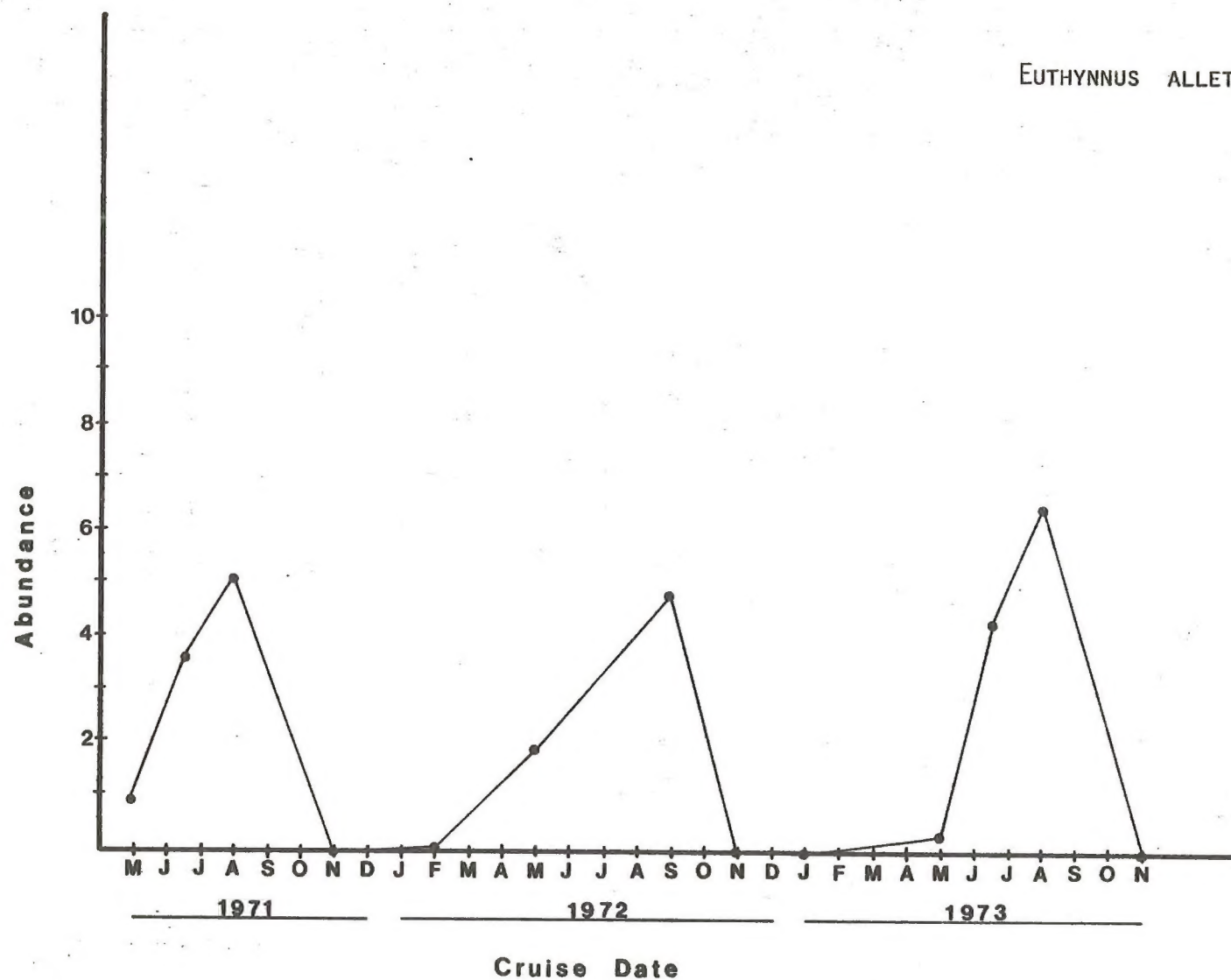


Fig. 120 Estimated mean abundances (number under 10m² of sea surface) of *Euthynnus alletteratus* larvae in the eastern Gulf of Mexico, 1971-1974.

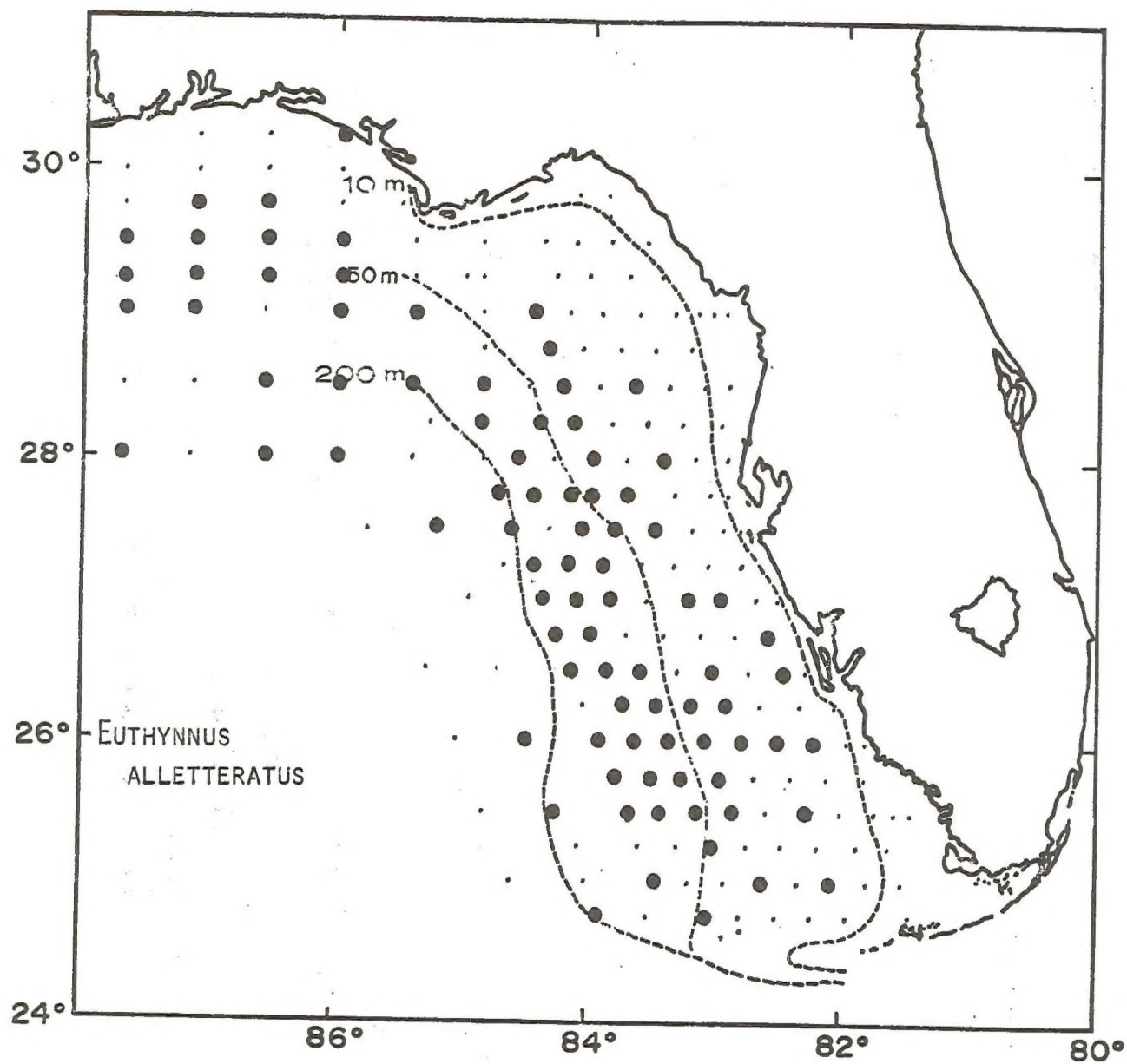


Fig. 121

Stations at which *Euthynnus alletteratus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

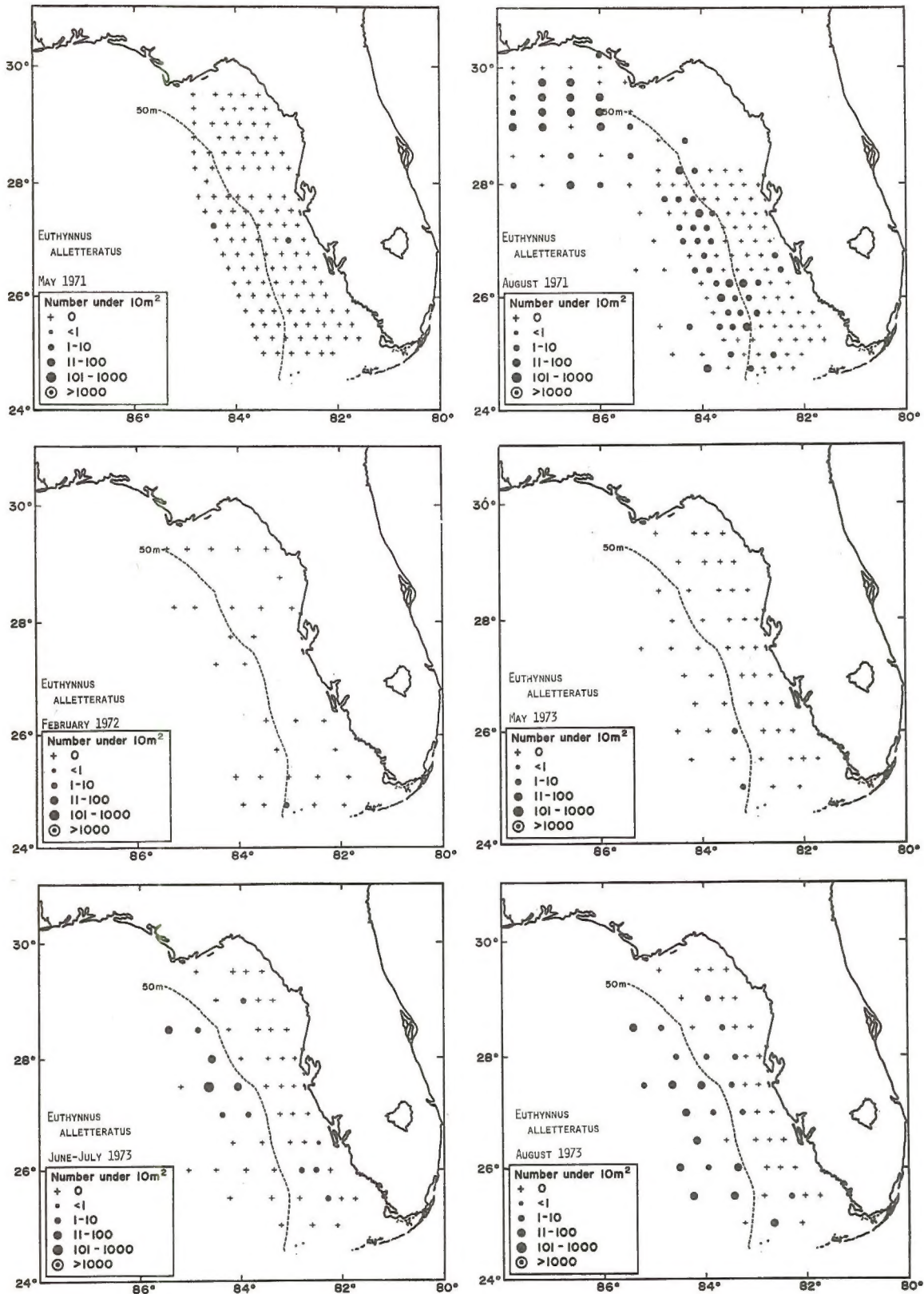


Fig. 122 Distribution and abundance of *Euthynnus alletteratus* larvae in the eastern Gulf of Mexico, 1971-1974.

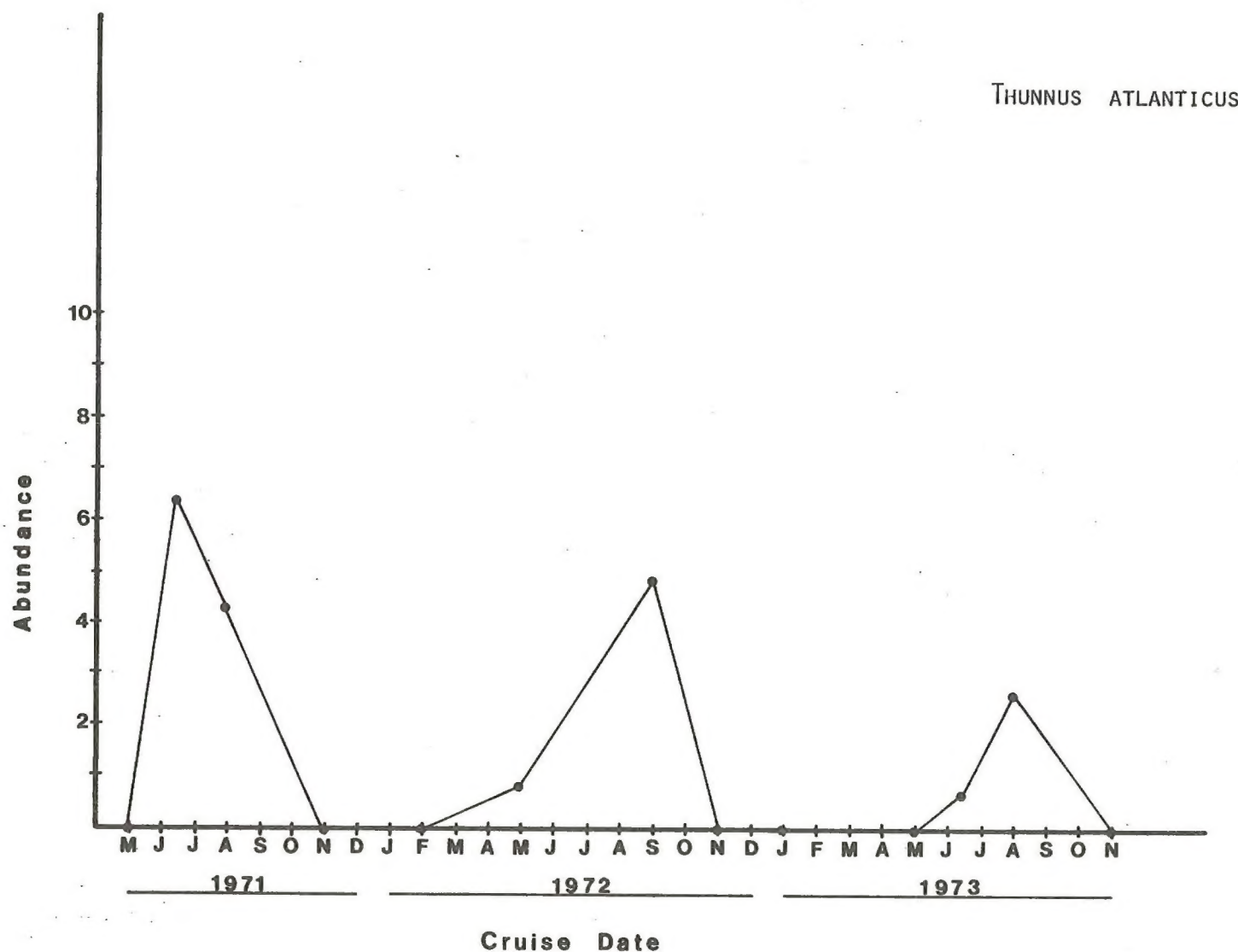


Fig. 123 Estimated mean abundances (number under 10m² of sea surface) of Thunnus atlanticus larvae in the eastern Gulf of Mexico, 1971-1974.

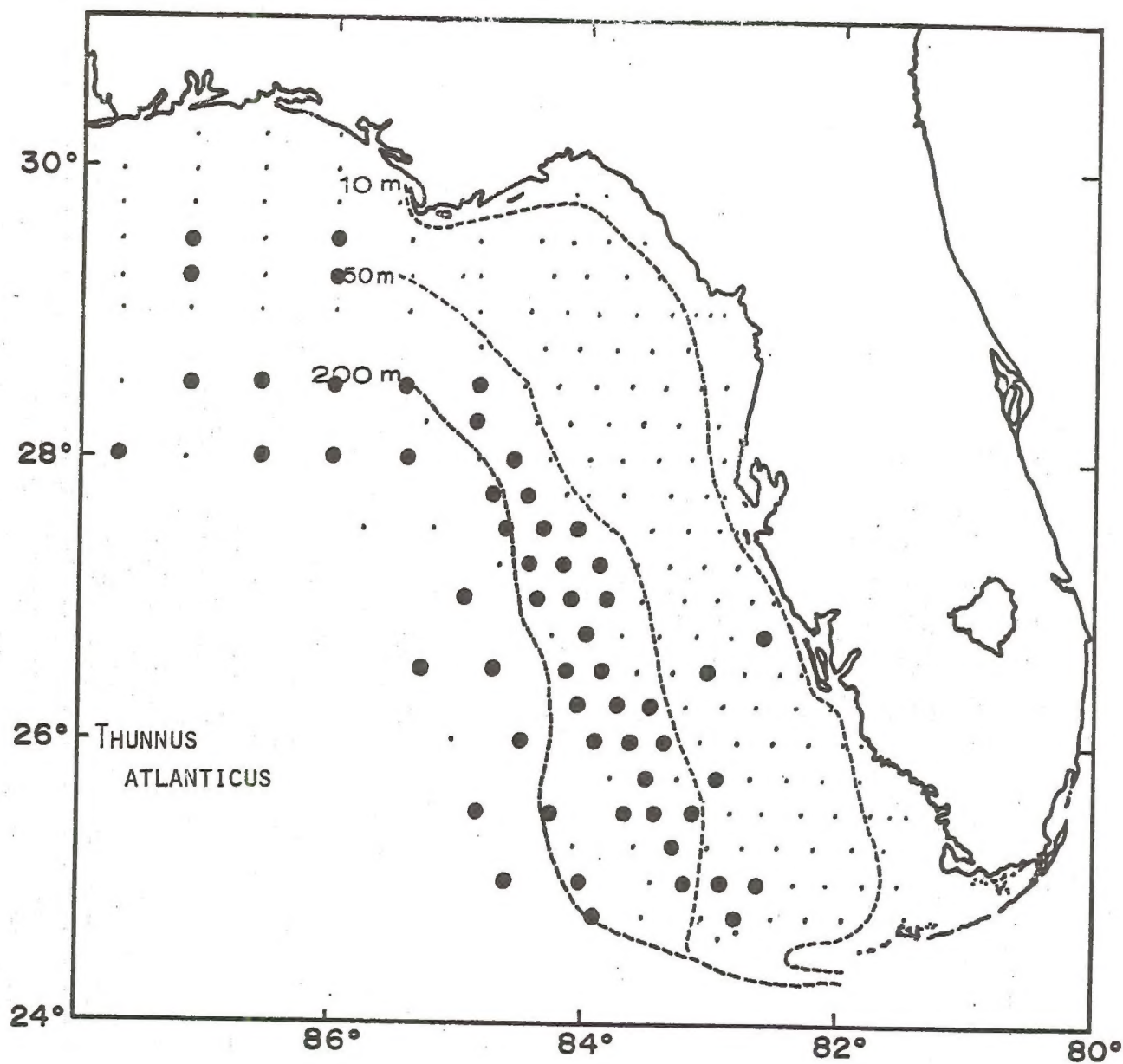


Fig. 124

Stations at which *Thunnus atlanticus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

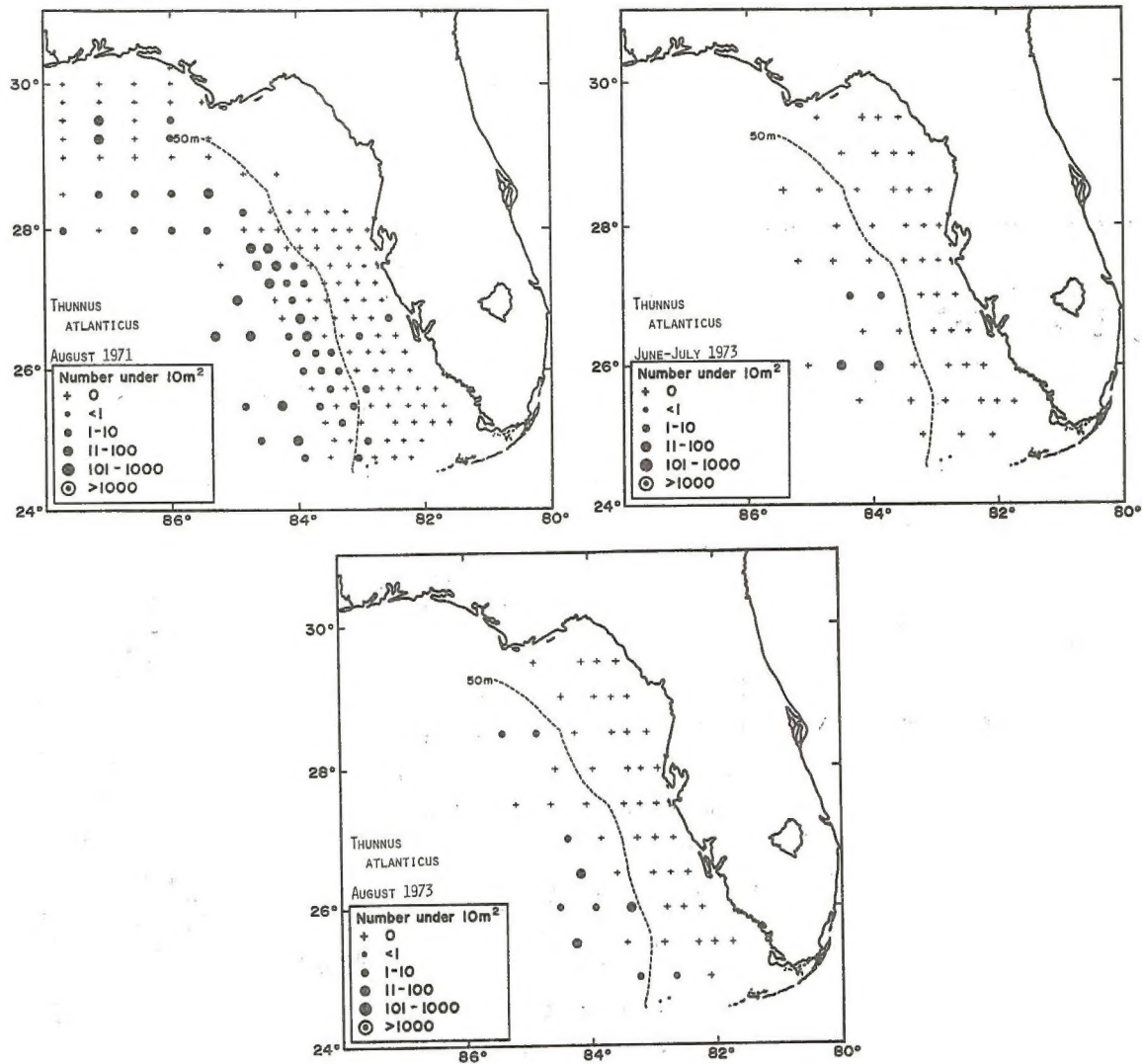


Fig. 125 Distribution and abundance of *Thunnus atlanticus* larvae in the eastern Gulf of Mexico, 1971-1974.

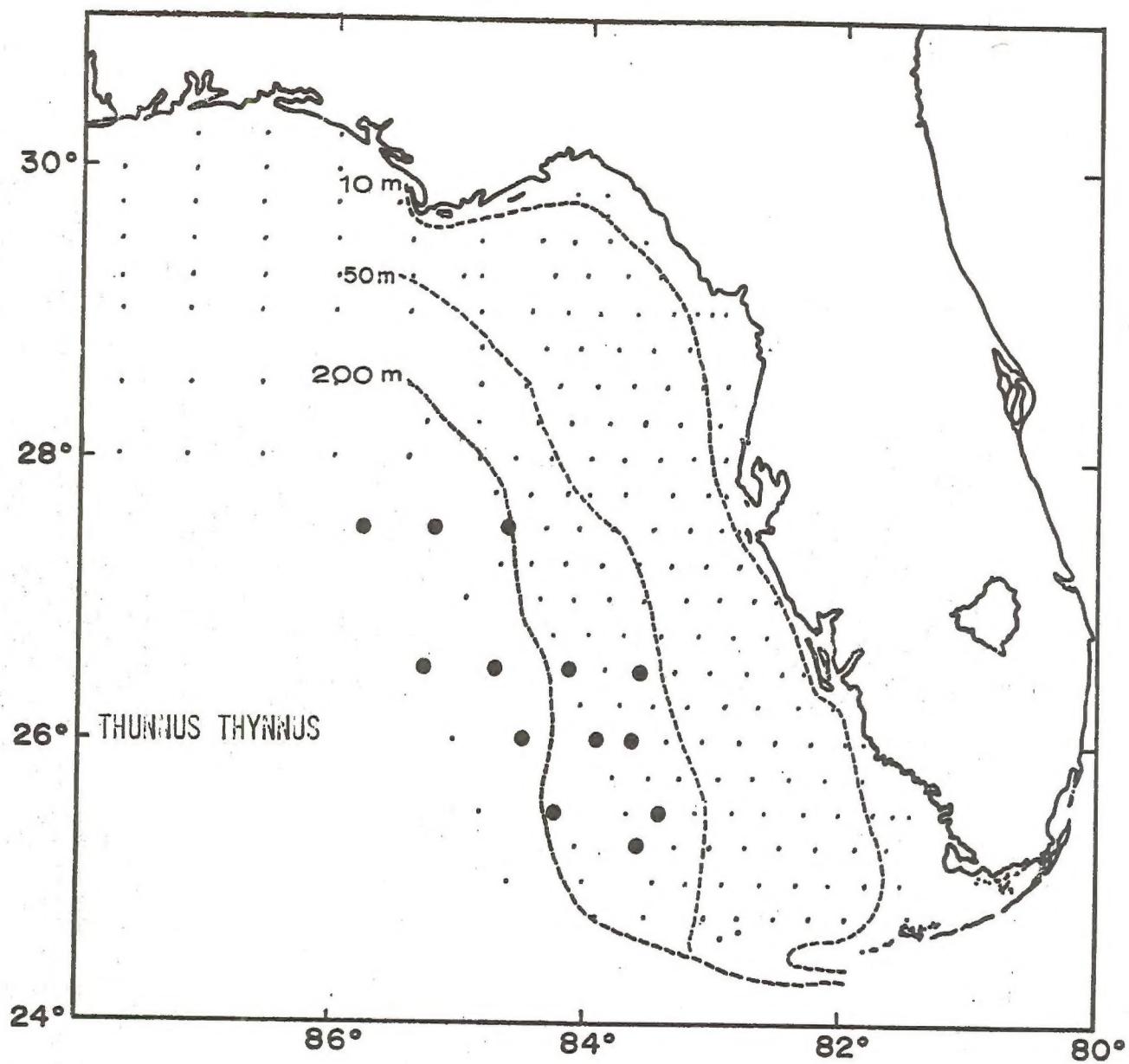


Fig. 126

Stations at which Thunnus thynnus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

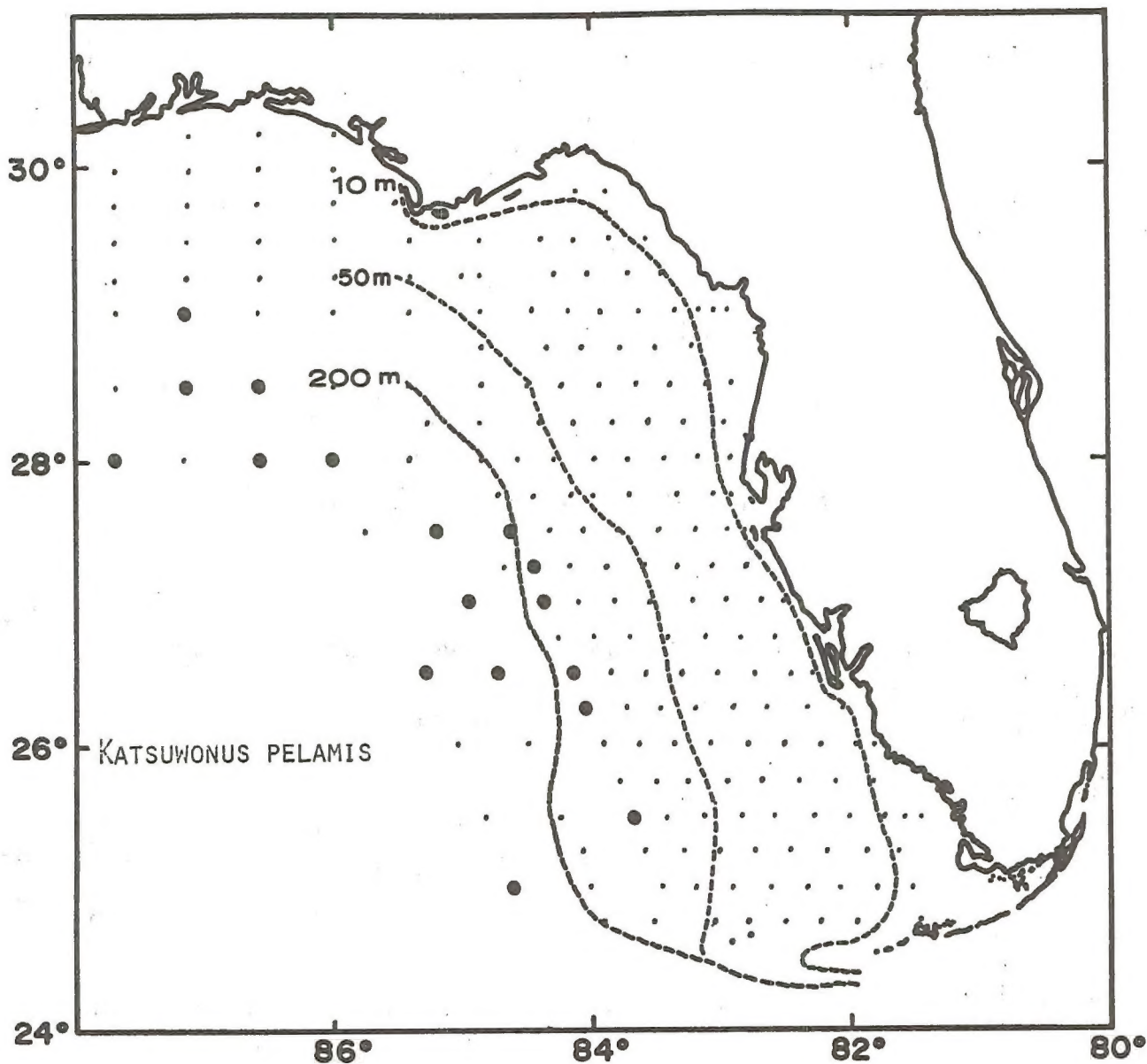


Fig. 127

Stations at which *Katsuwonus pelamis* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

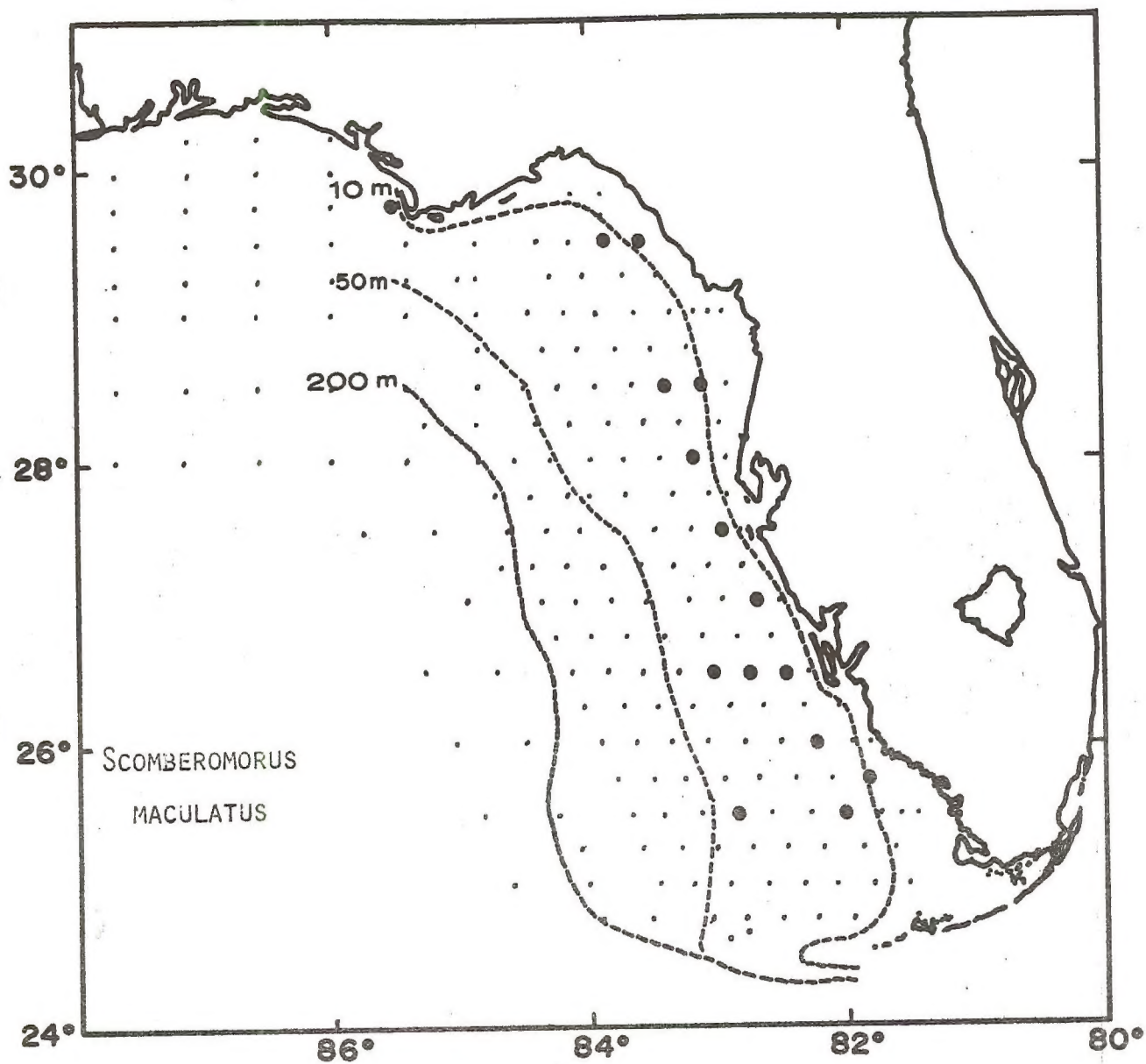


Fig. 128

Stations at which Scomberomorus maculatus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

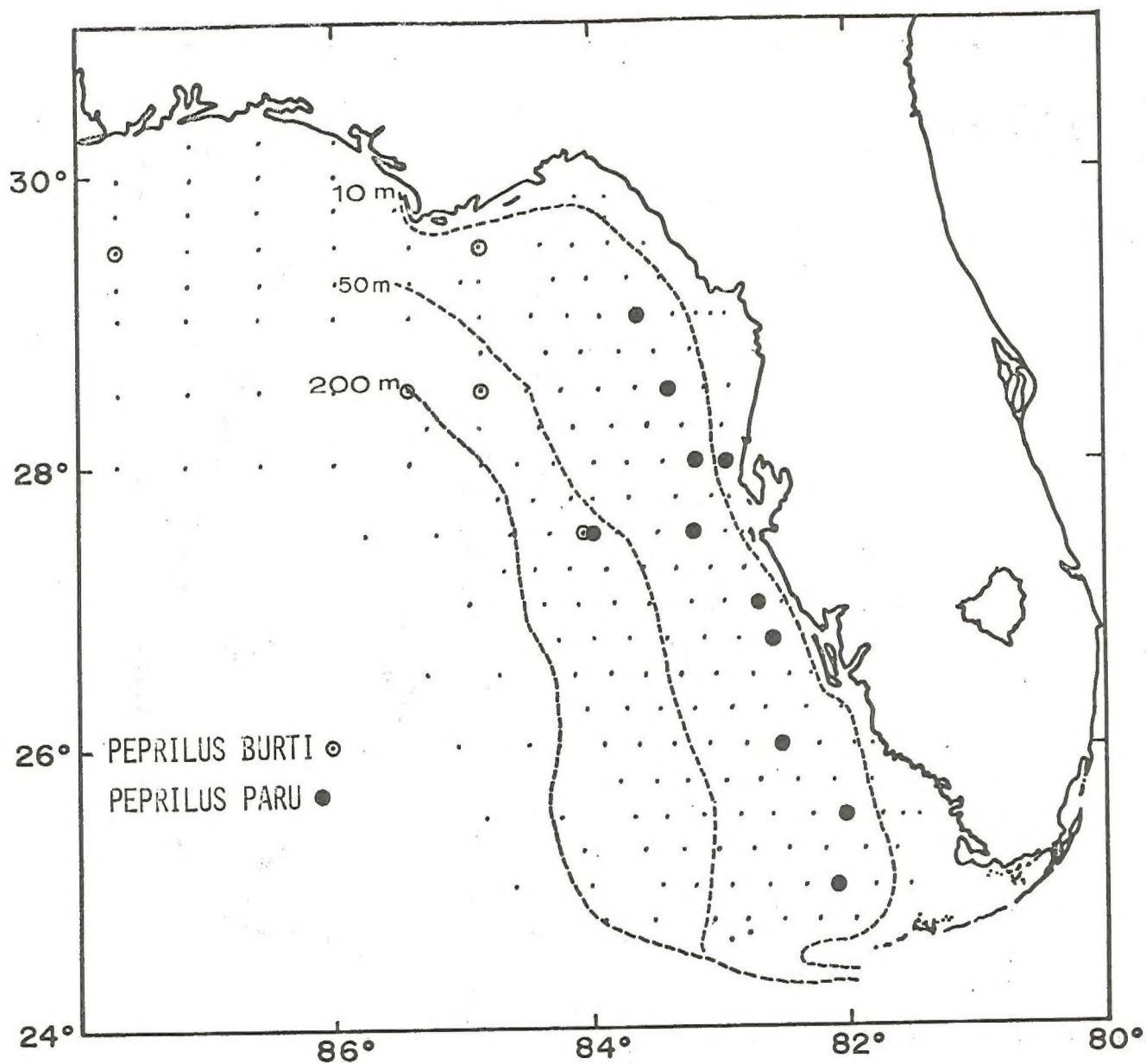


Fig. 129

Stations at which *Peprilus paru* and *Peprilus burti* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

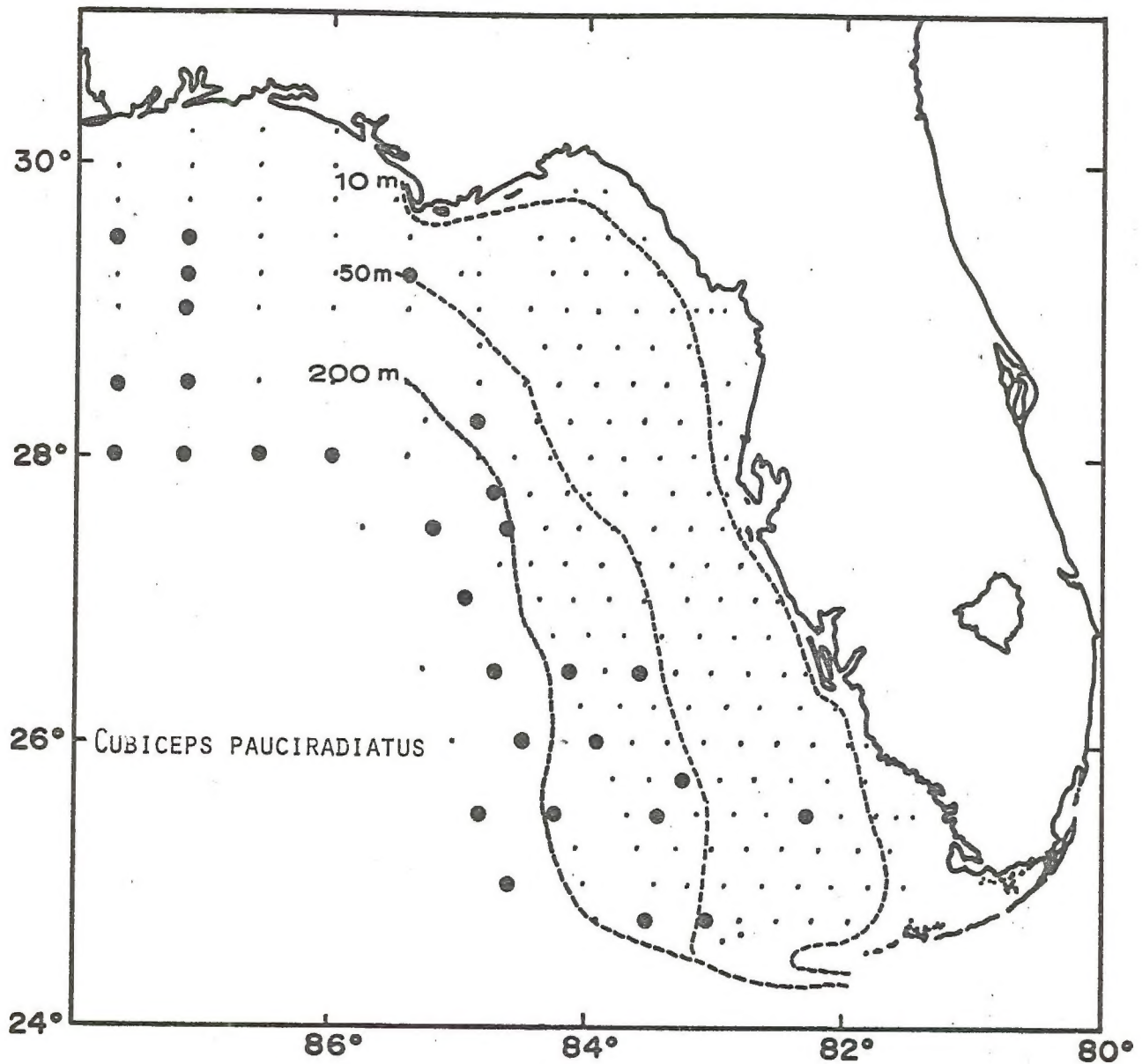


Fig. 130

Stations at which *Cubiceps pauciradiatus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

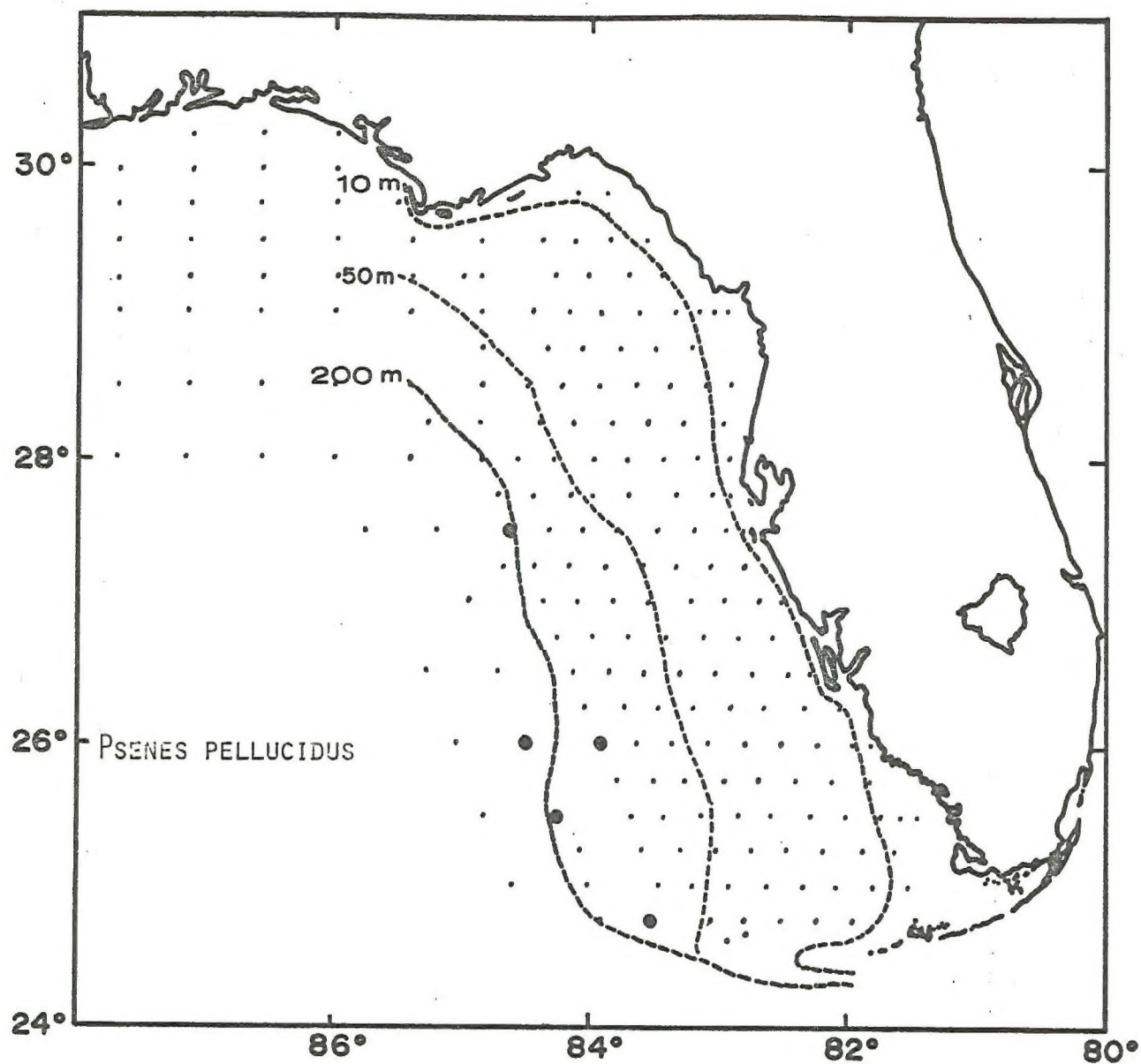
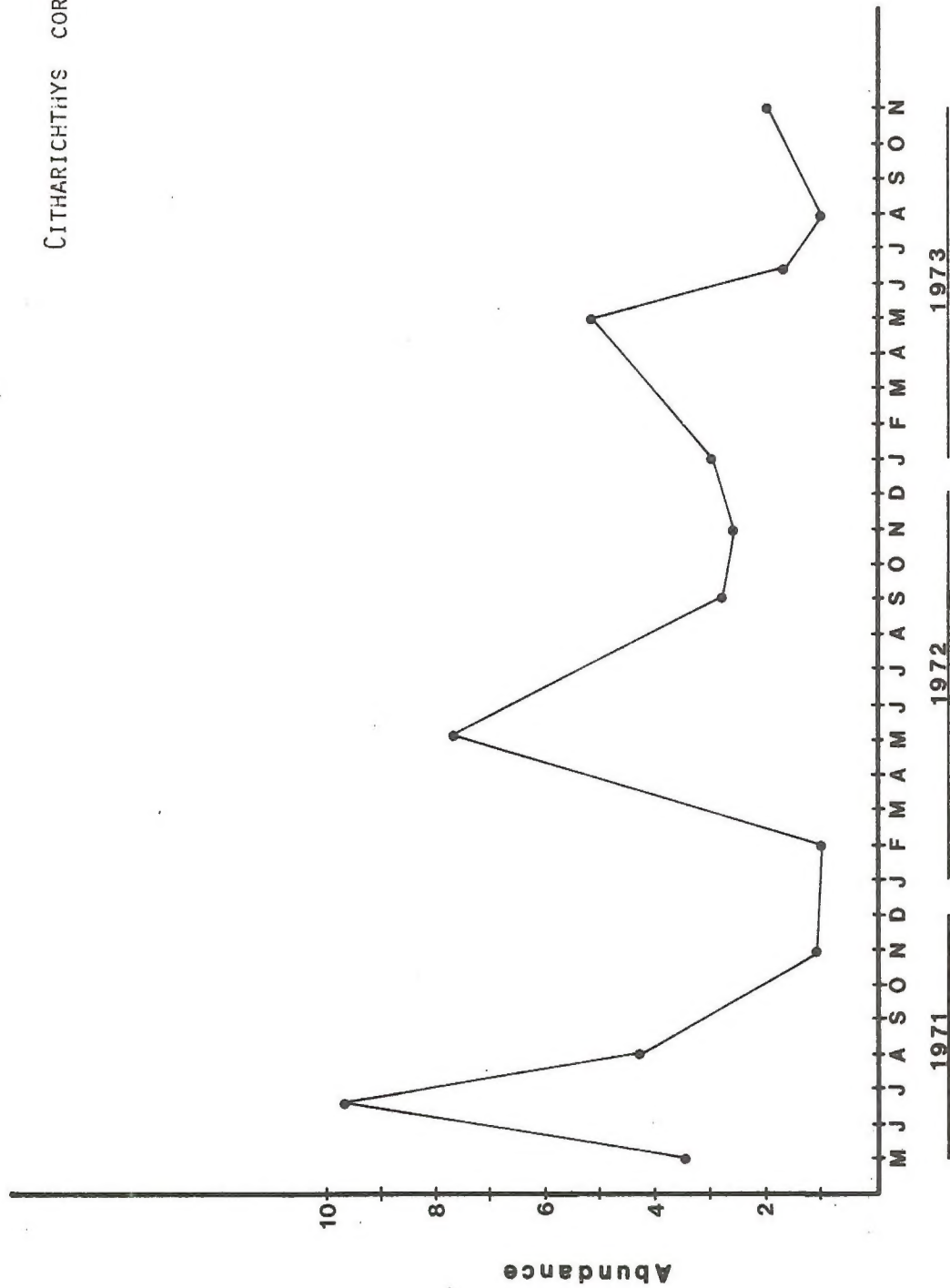


Fig. 131 Stations at which *Psenes pellucidus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

CITHARICHTHYS CORNUTUS



Cruise Date

Fig. 132 Estimated mean abundances (number under 10 m² of sea surface) of *Citharichthys cornutus* larvae in the eastern Gulf of Mexico, 1971-1974.

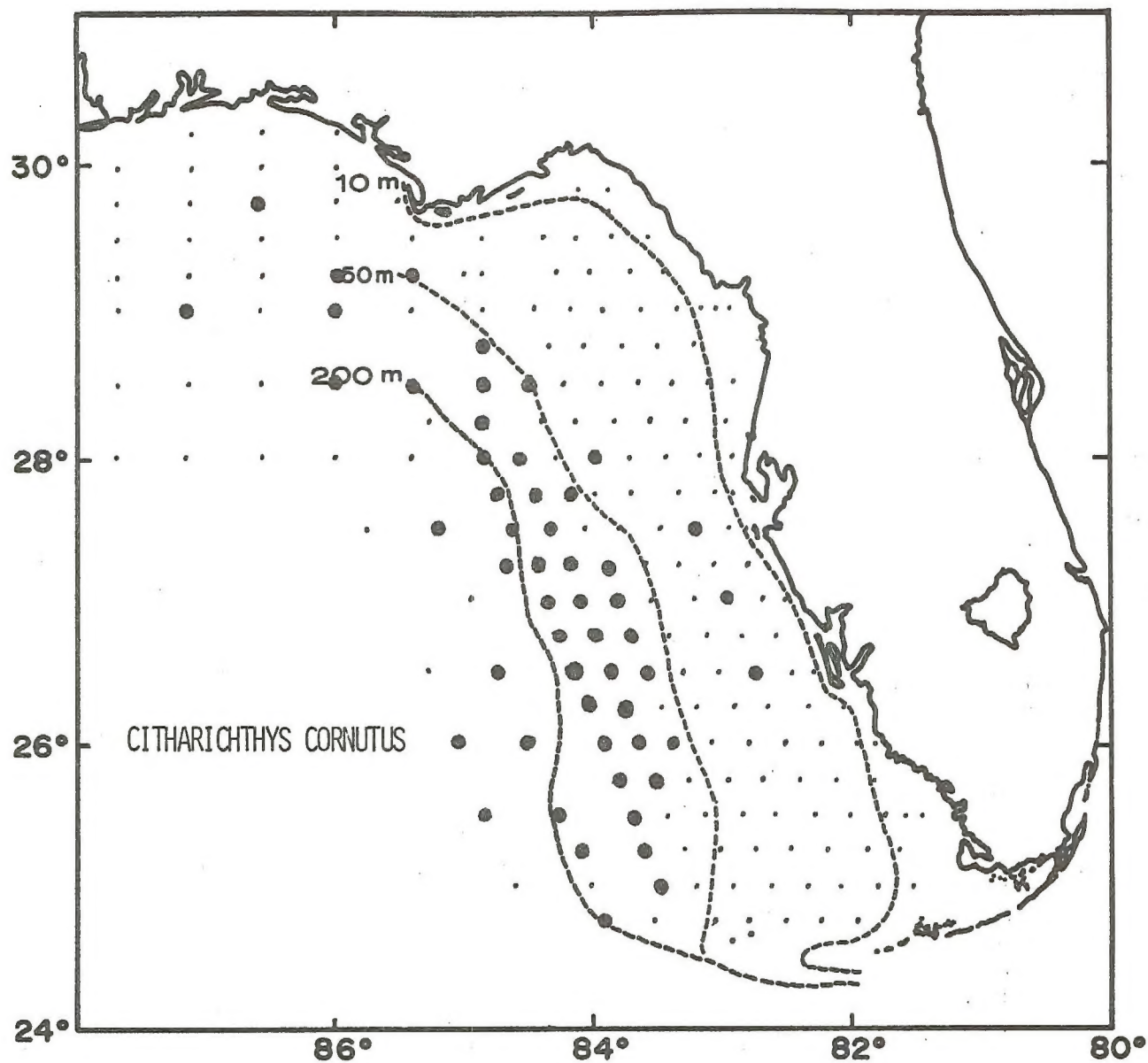


Fig. 133 Stations at which *Citharichthys cornutus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

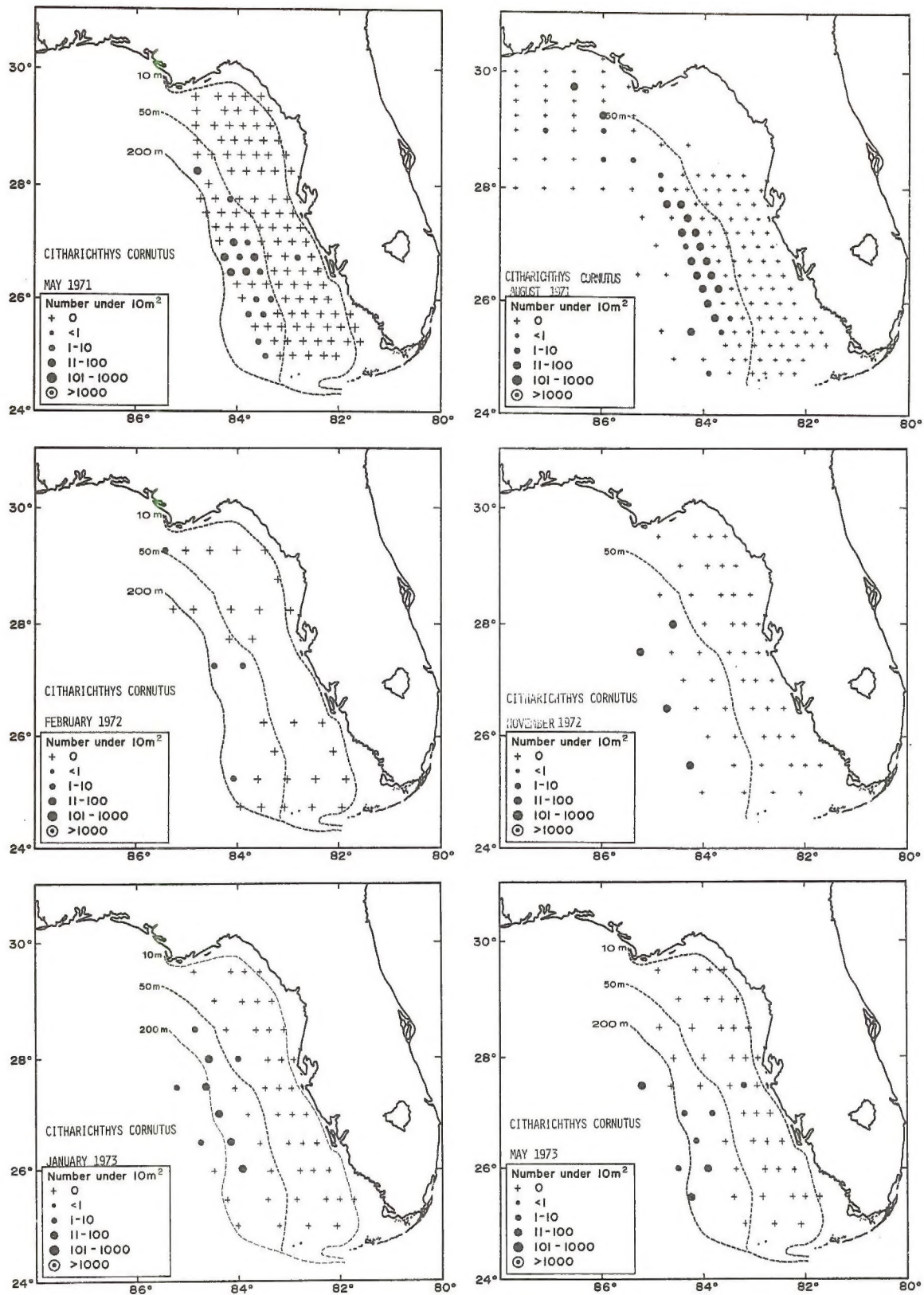


Fig. 134 Distribution and abundance of *Citharichthys cornutus* larvae in the eastern Gulf of Mexico, 1971-1974.

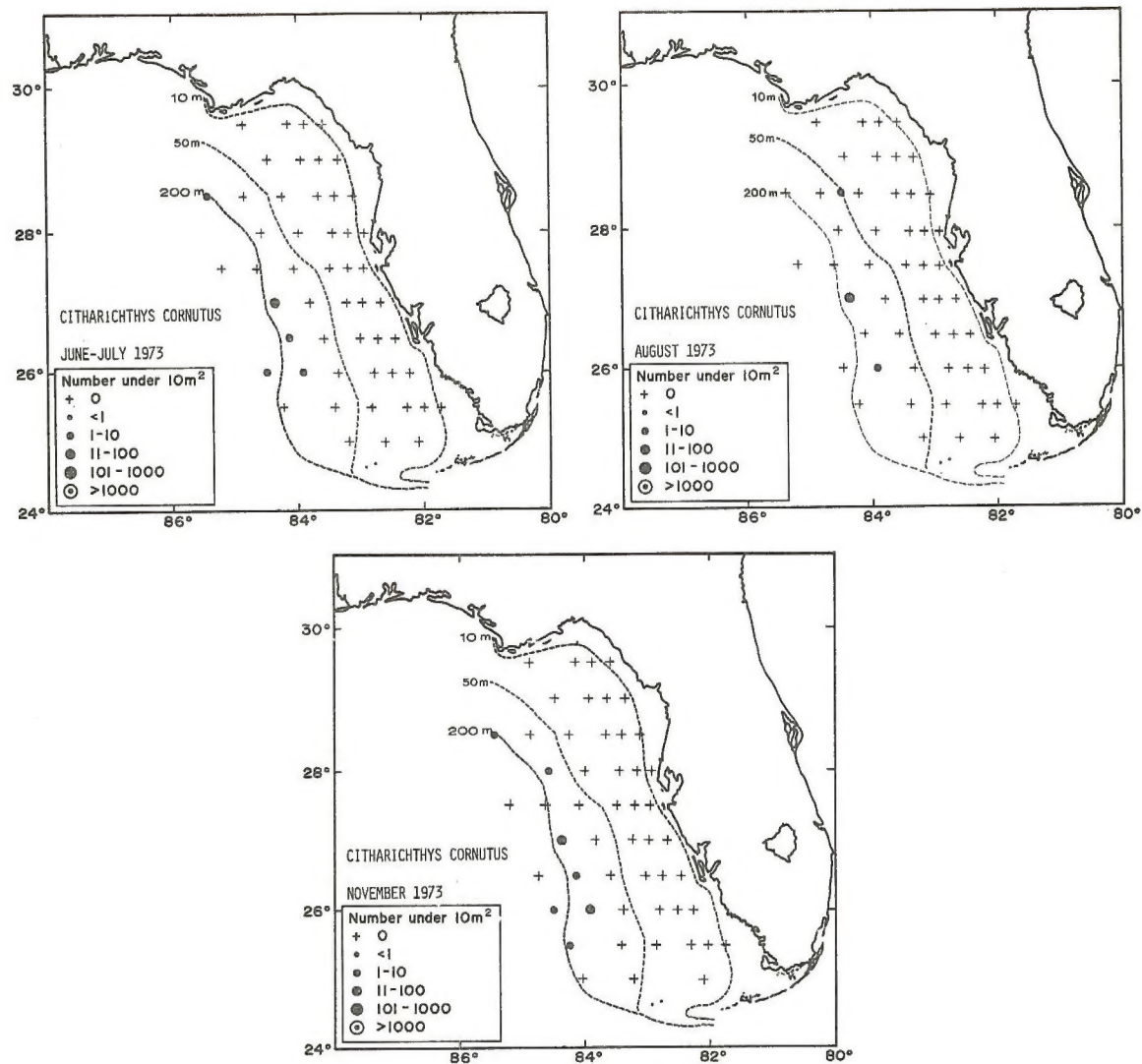


Fig. 134

Cont.

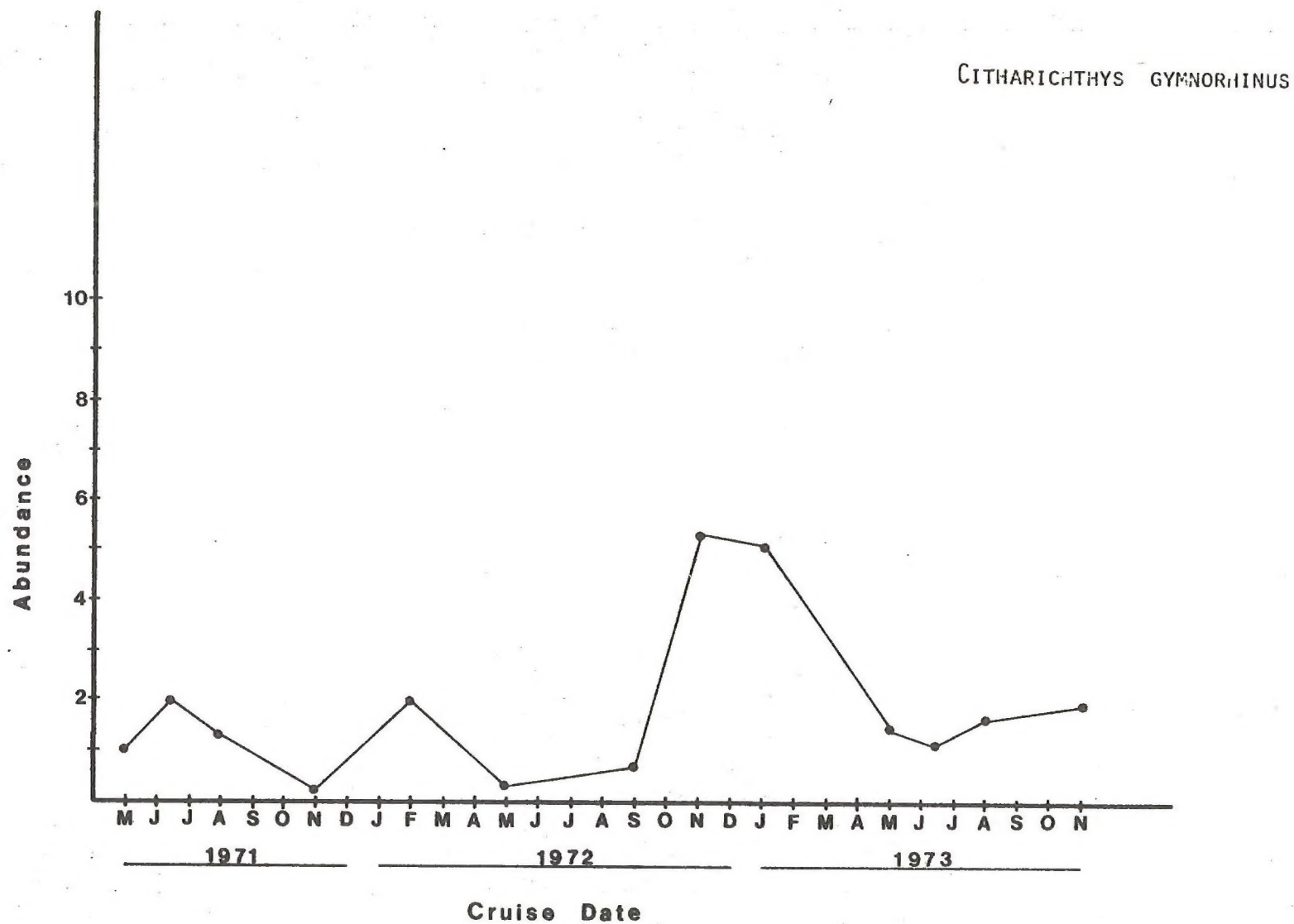


Fig. 135 Estimated mean abundances (number under 10 m² of sea surface) of Citharichthys gymnotrinus larvae in the eastern Gulf of Mexico, 1971-1974.

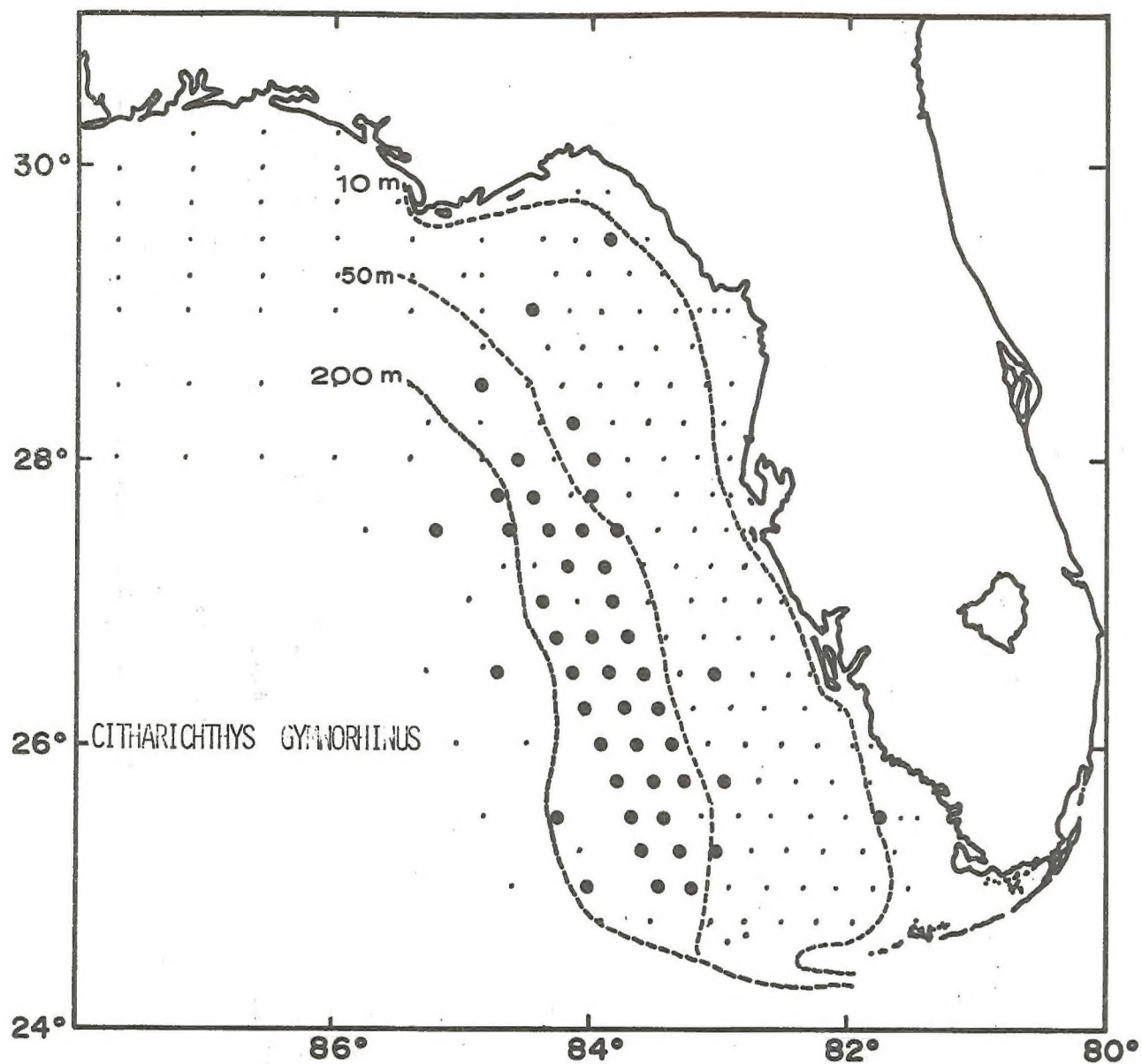


Fig. 136 Stations at which *Citharichthys gymnorhinus* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

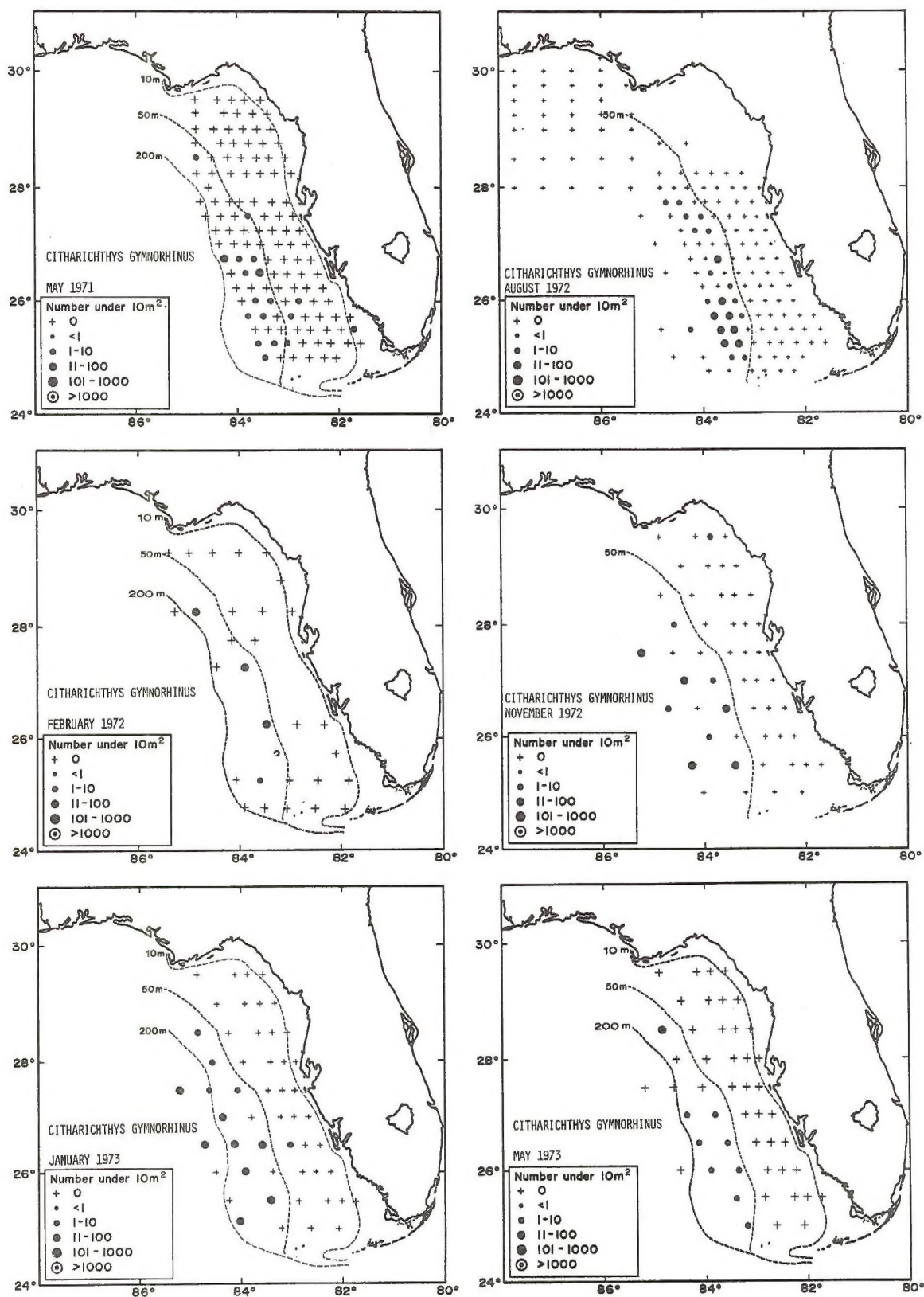


Fig. 137 Distribution and abundance of *Citharichthys gymnorhinus* larvae in the eastern Gulf of Mexico, 1971-1974.

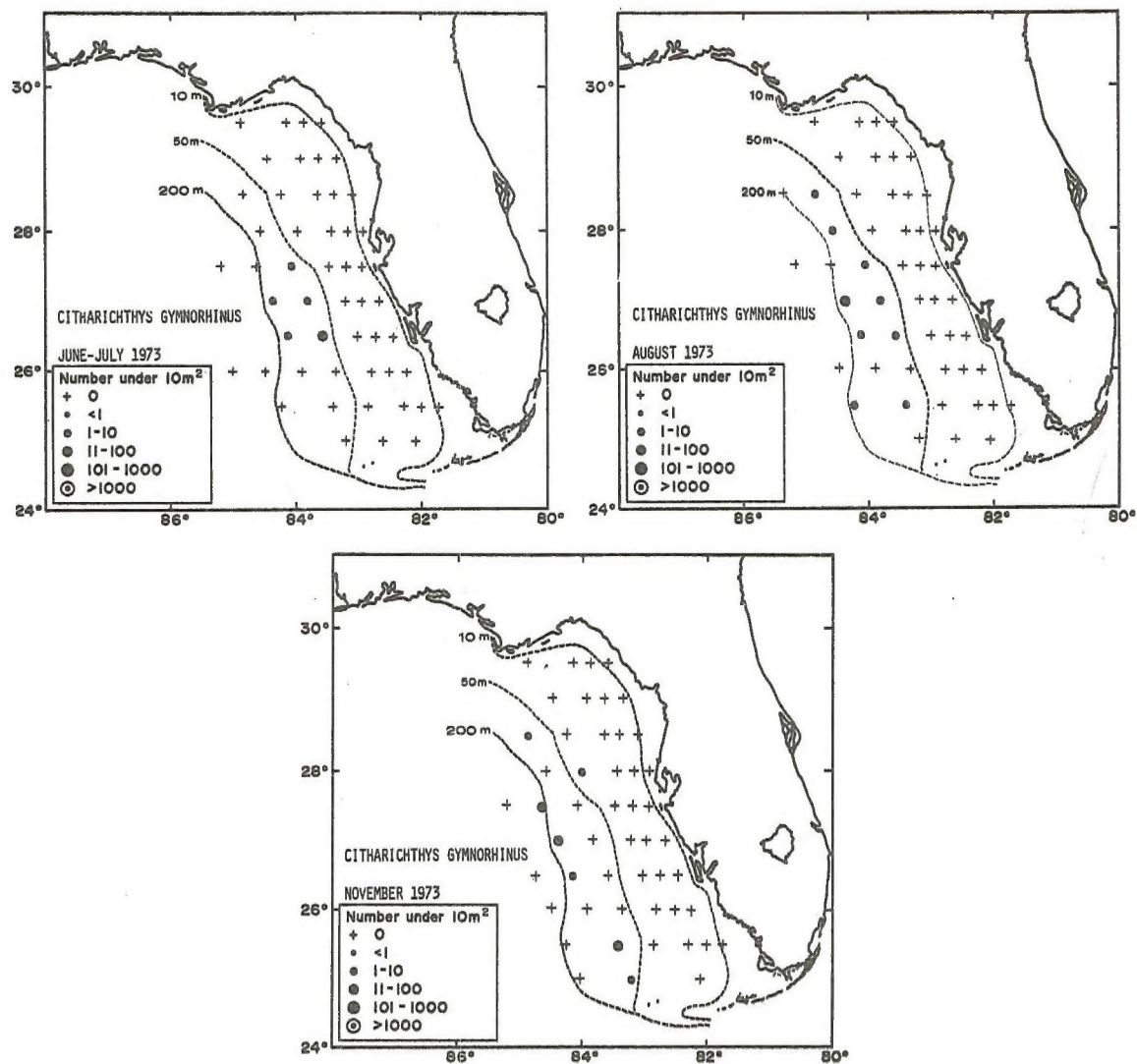


Fig. 137 Cont.

CITHARICHTHYS MACROPS

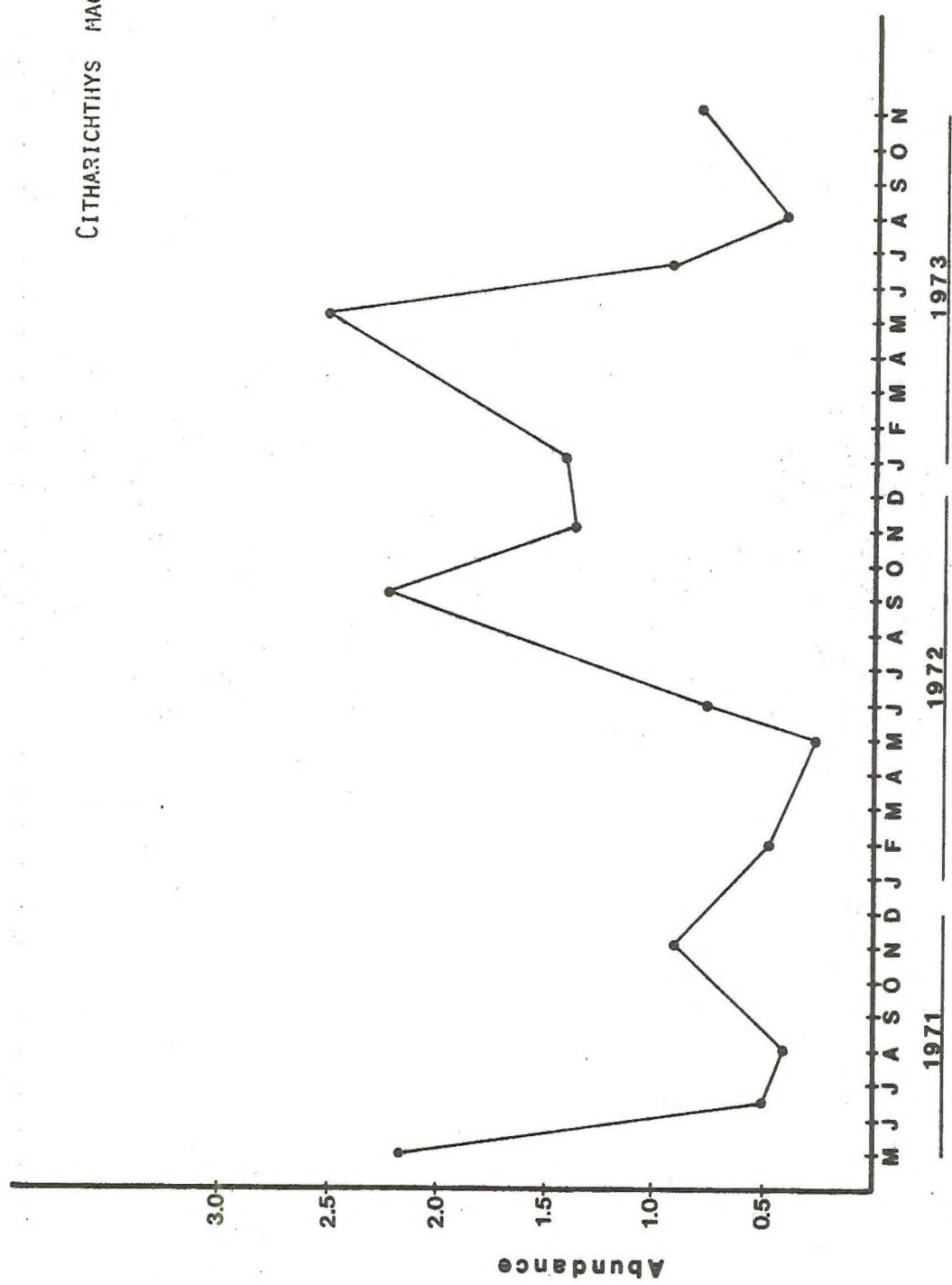


Fig. 138

Estimated mean abundances (number under 10 m² of sea surface) of Citharichthys macrops larvae in the eastern Gulf of Mexico, 1971-1974.

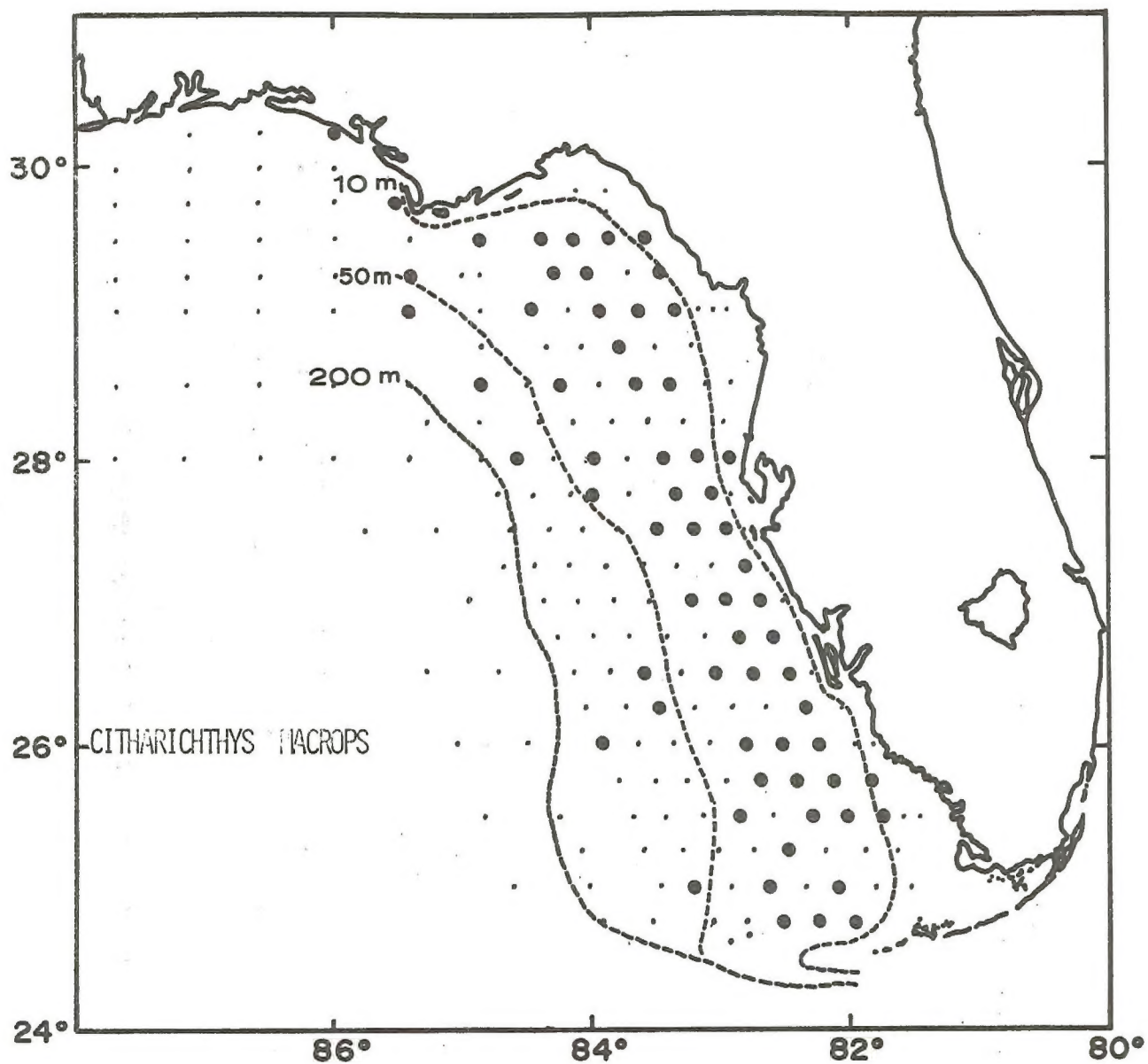


Fig. 139 Stations at which *Citharichthys macrops* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

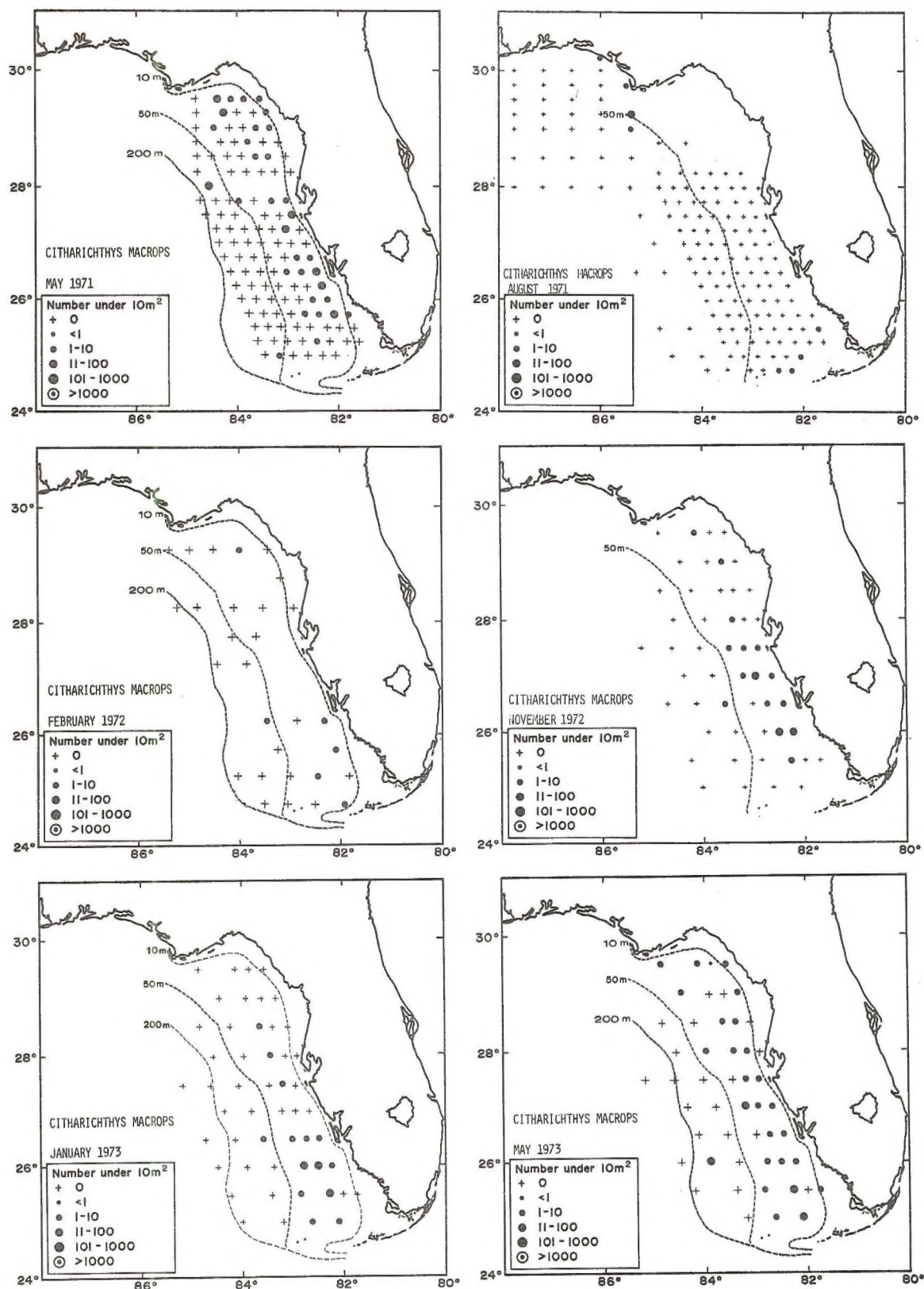


Fig. 140 Distribution and abundance of *Citharichthys macrops* larvae in the eastern Gulf of Mexico, 1971-1974.

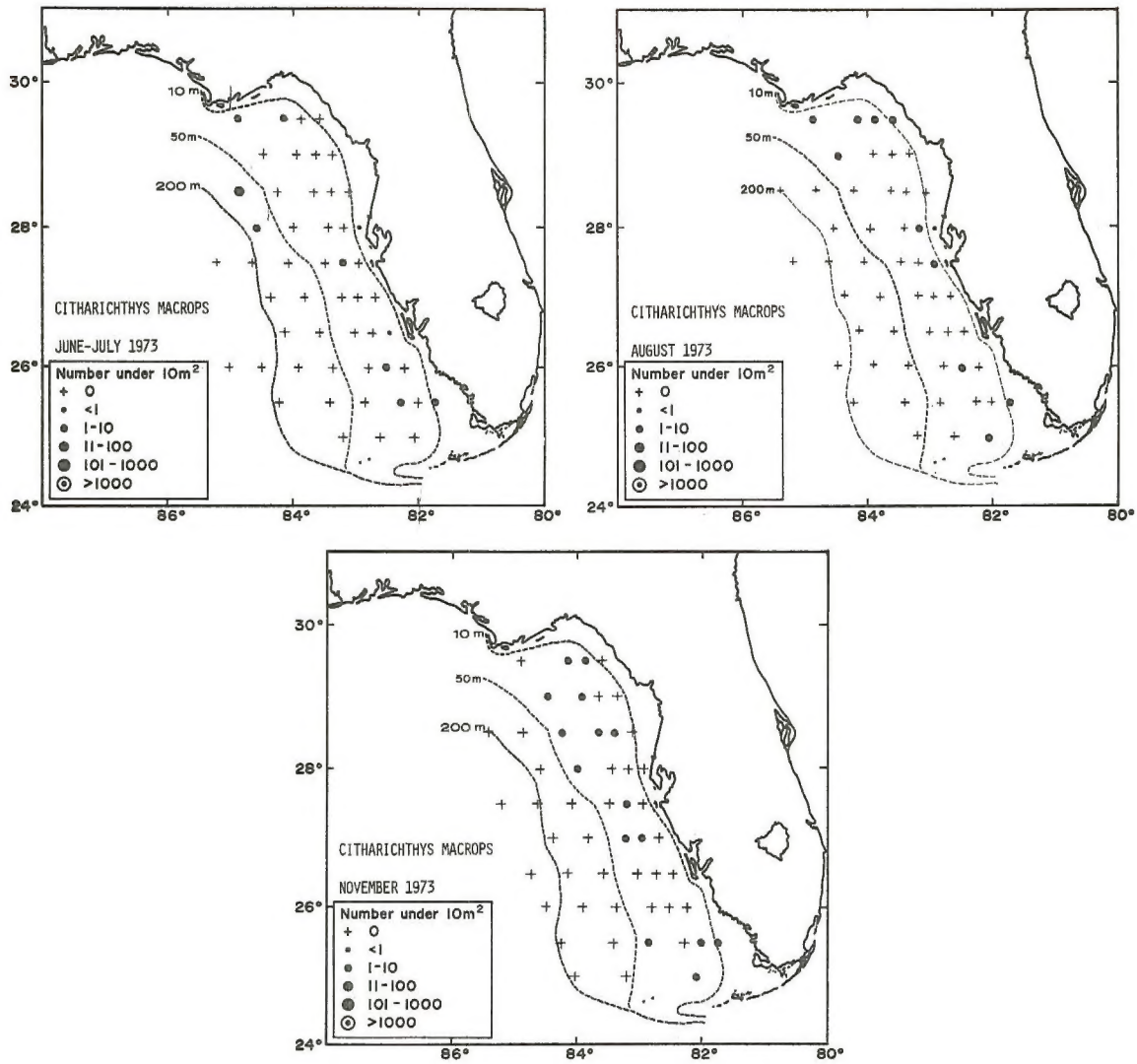


Fig. 140 Cont.

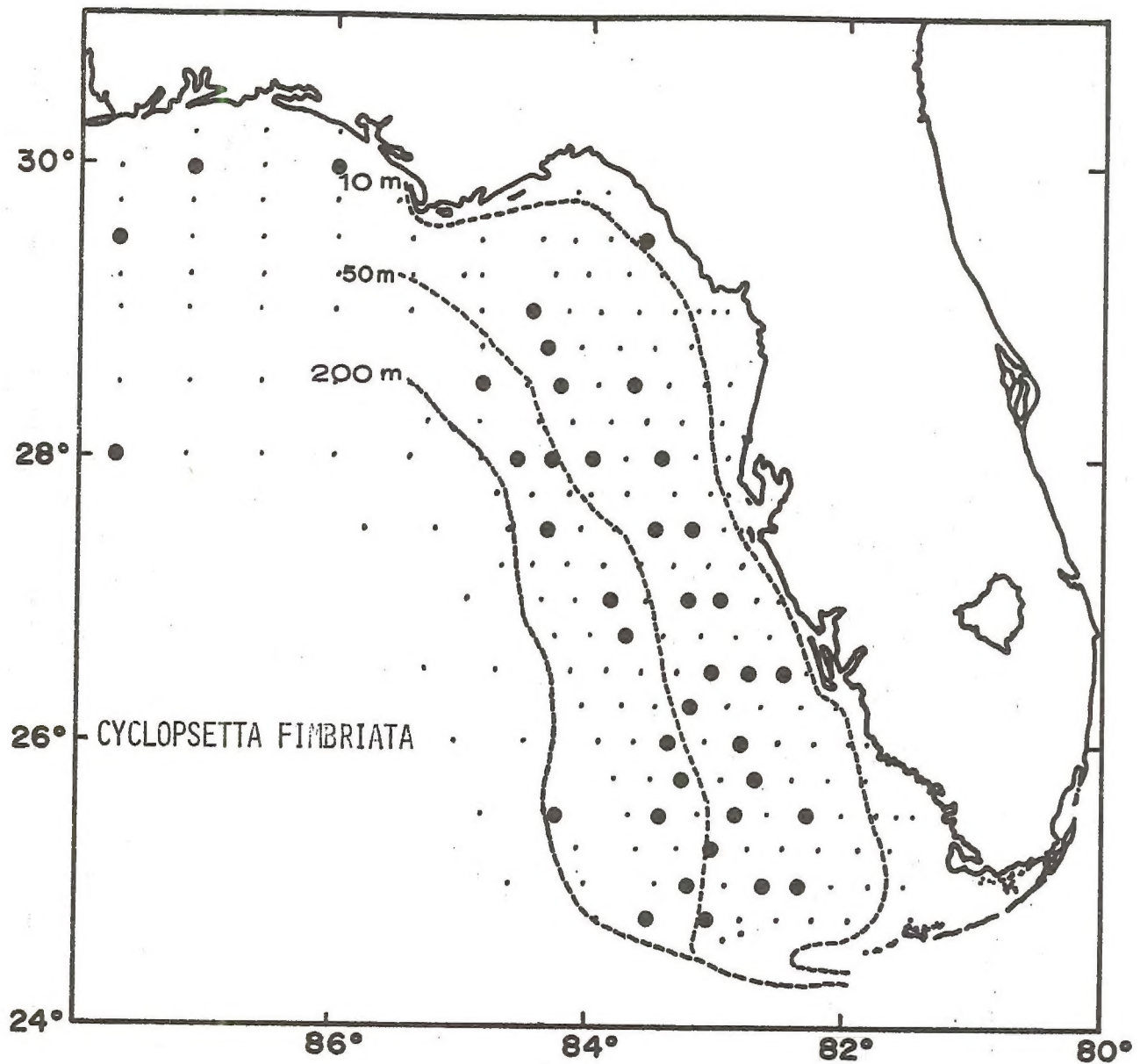


Fig. 141

Stations at which *Cyclopsetta fimbriata* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

ETROPUS RIMOSUS

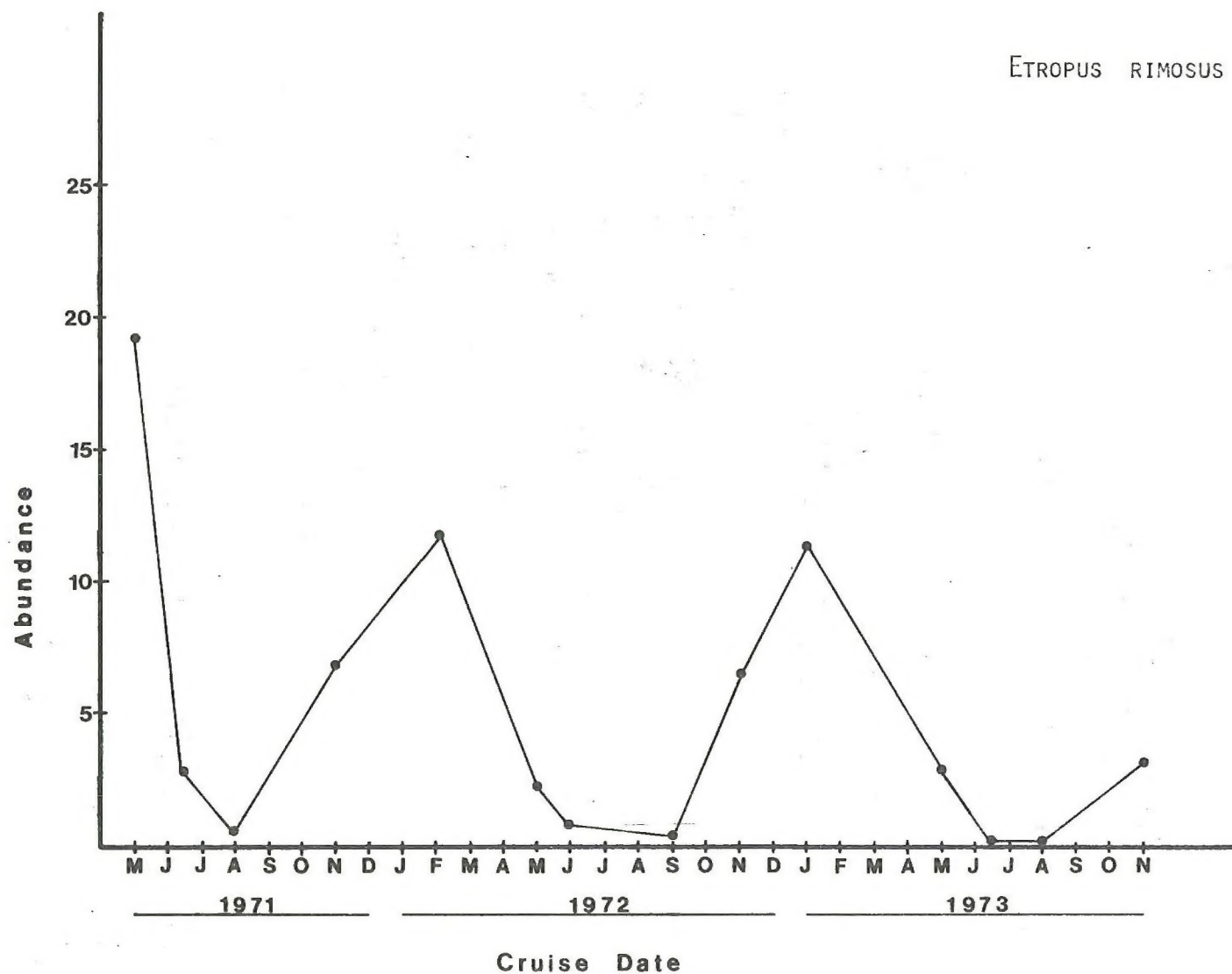


Fig. 142 Estimated mean abundances (number under 10 m² of sea surface) of *Etropus rimosus* larvae in the eastern Gulf of Mexico, 1971-1974.

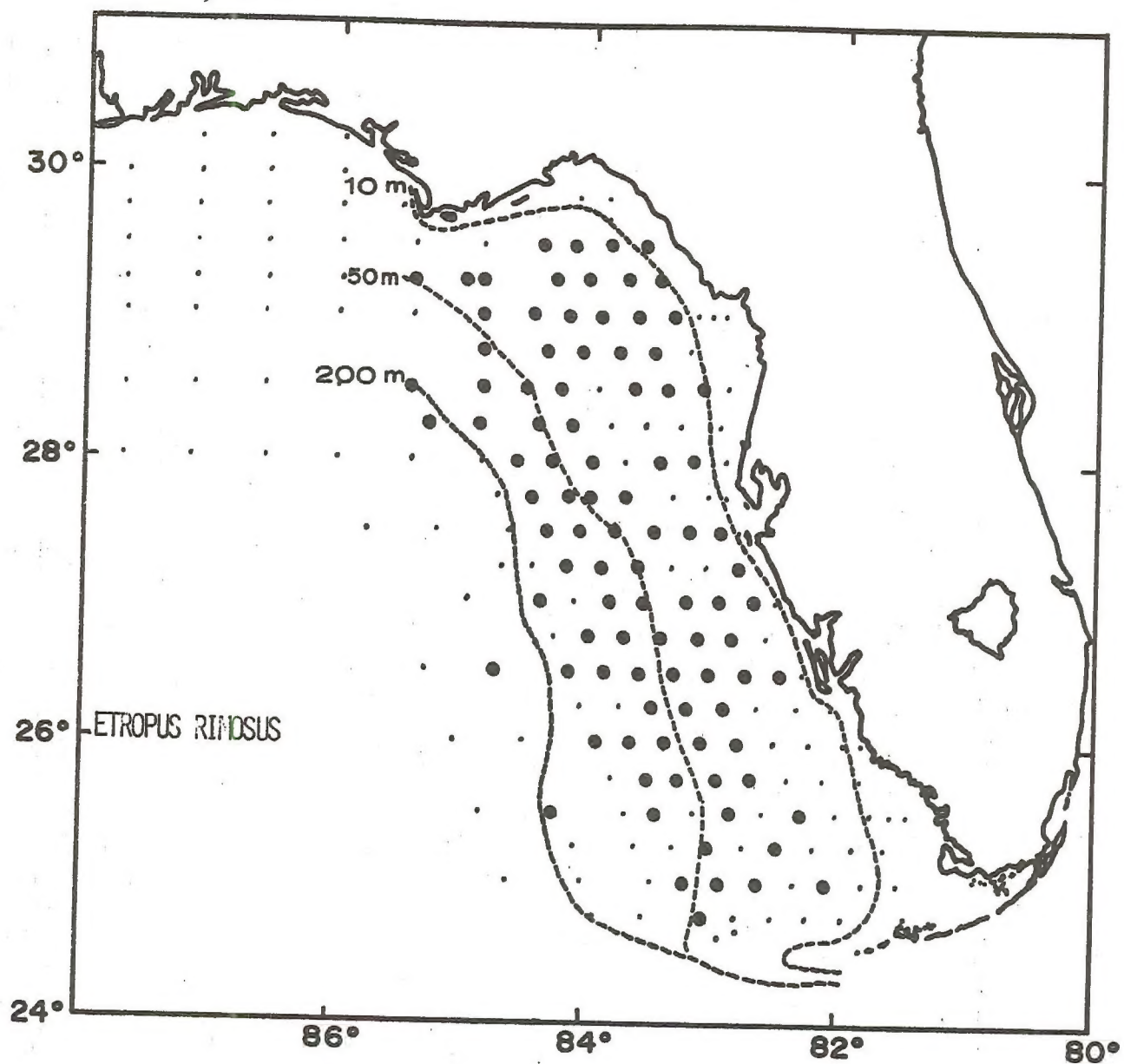


Fig. 143

Stations at which Etropus rimosus larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

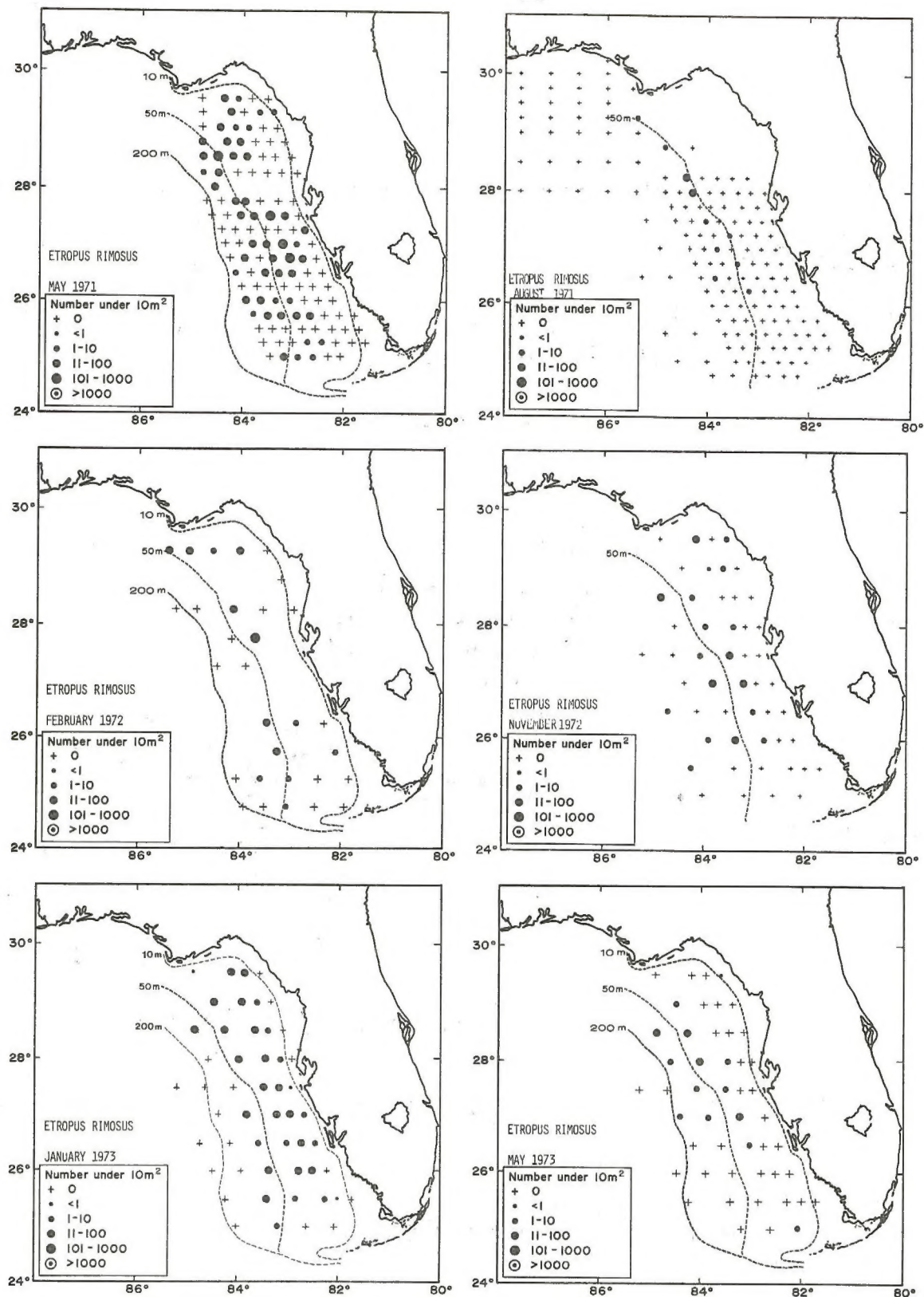


Fig. 144 Distribution and abundance of *Etropus rimosus* larvae in the eastern Gulf of Mexico, 1971-1974.

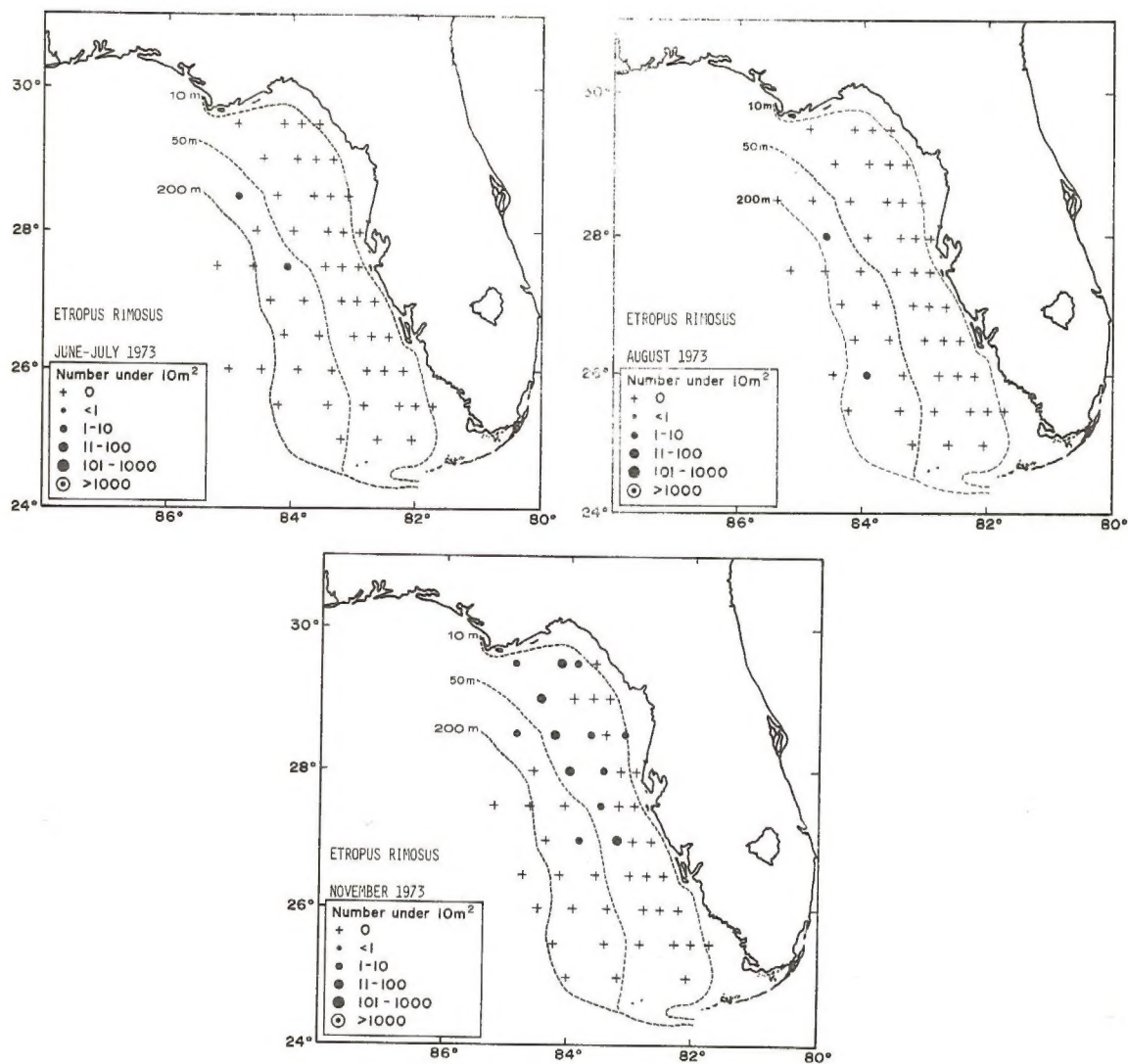


Fig. 144

Cont.

SYACIUM PAPILLOSUM

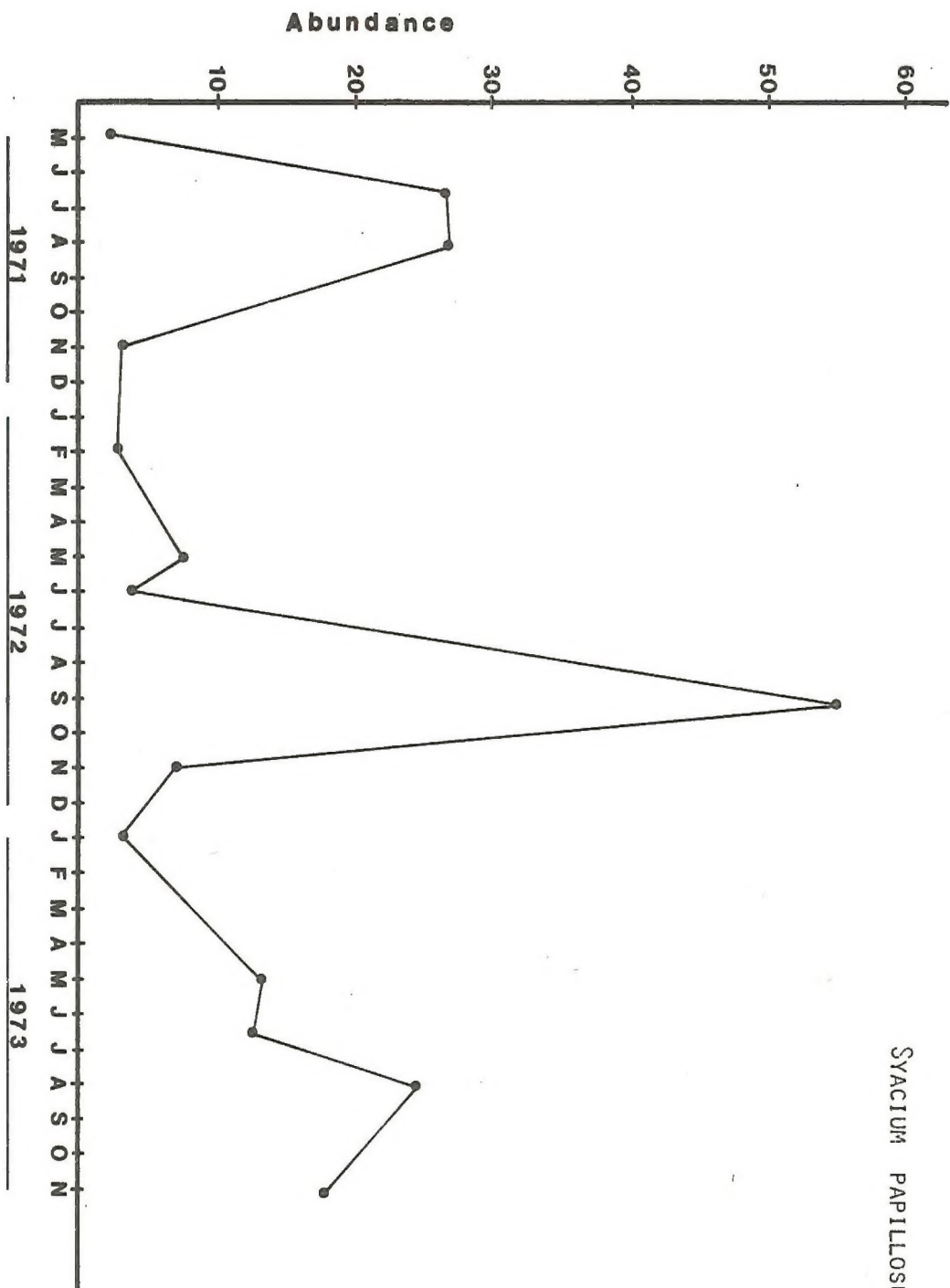


Fig. 145 Estimated mean abundances (number under 10 m² of sea surface) of *Syacium papillosum* larvae in the eastern Gulf of Mexico, 1971-1974.

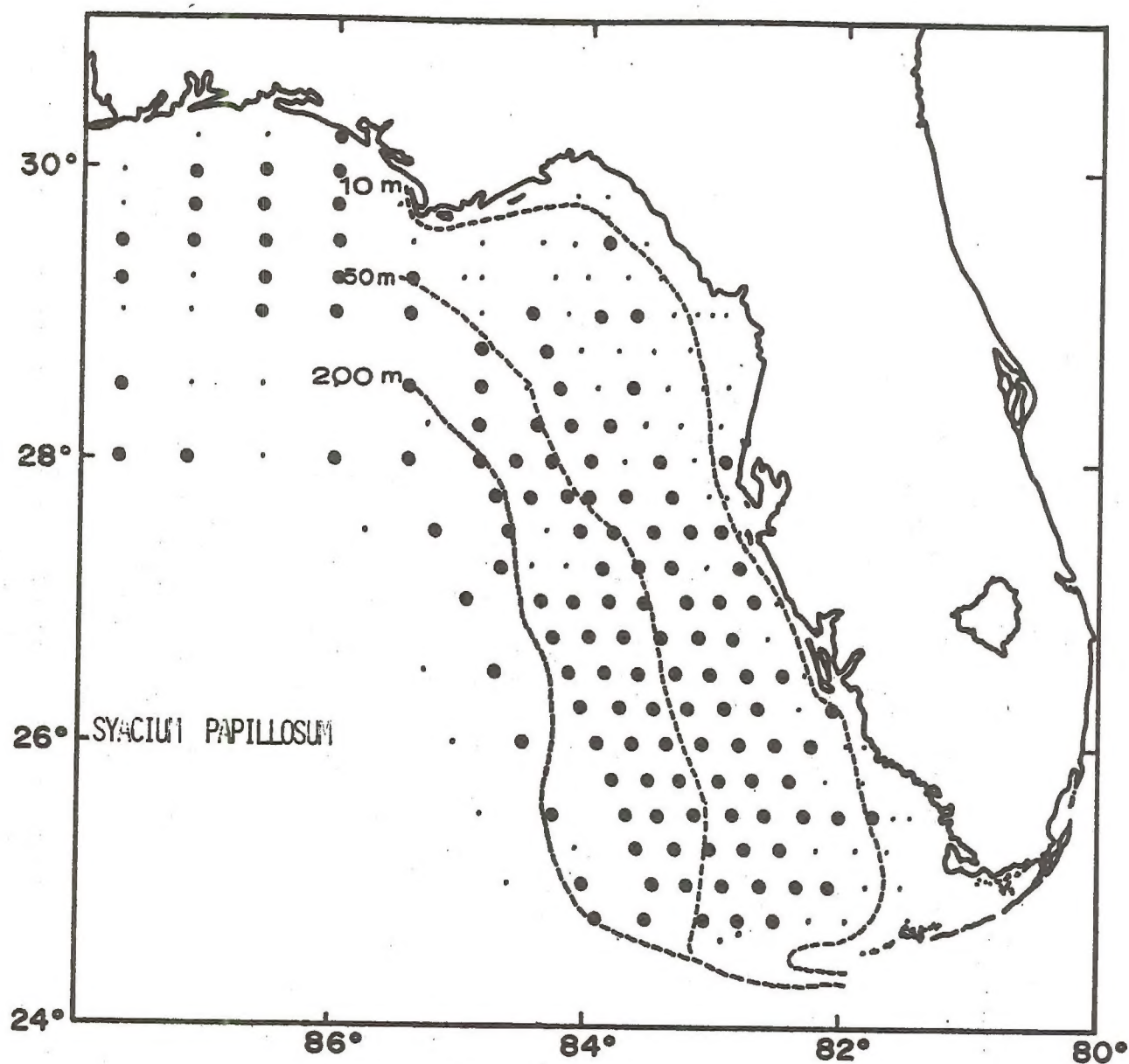


Fig. 146 Stations at which *Syacium papillosum* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

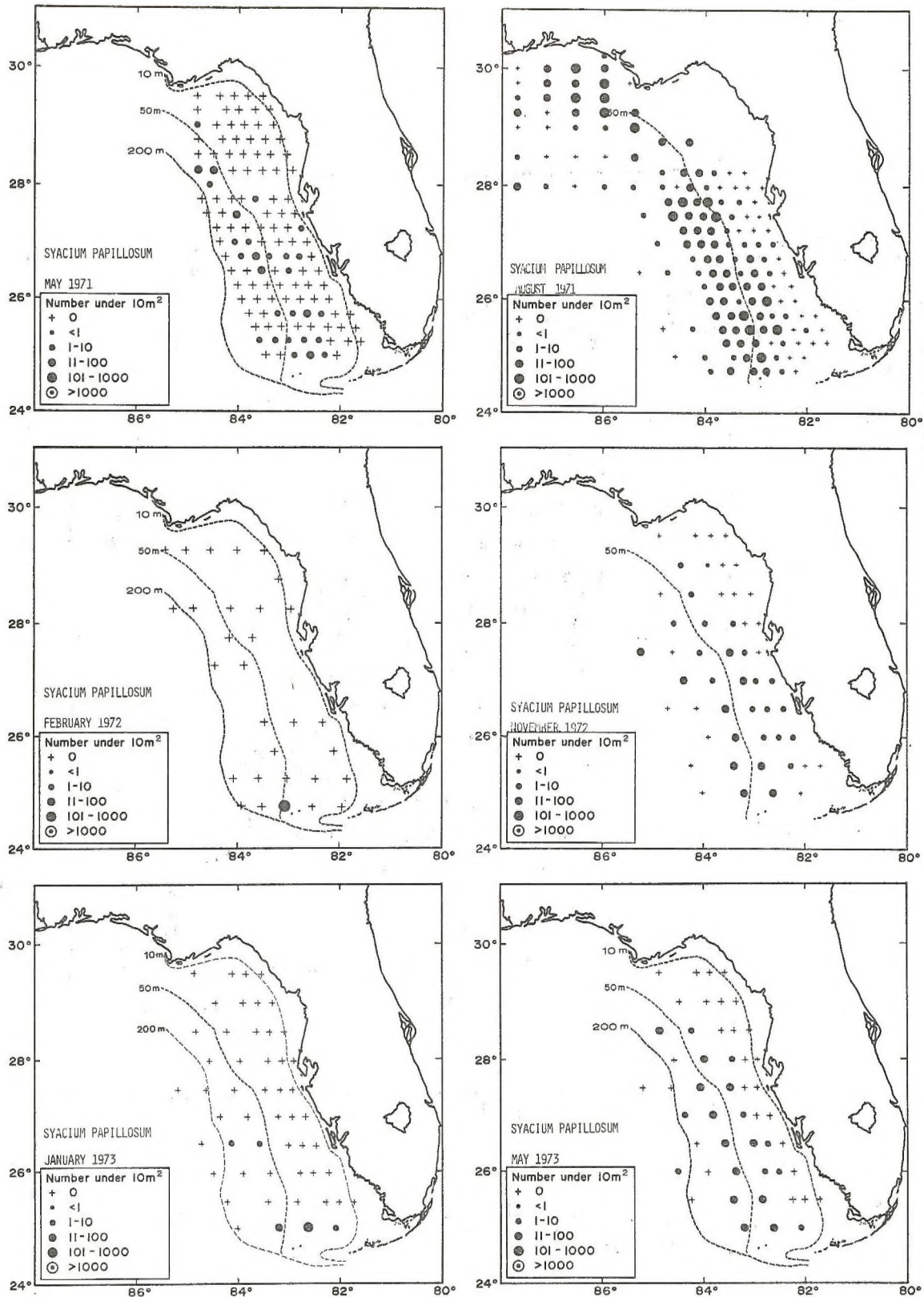


Fig. 147 Distribution and abundance of *Syacium papillosum* larvae in the eastern Gulf of Mexico, 1971-1974.

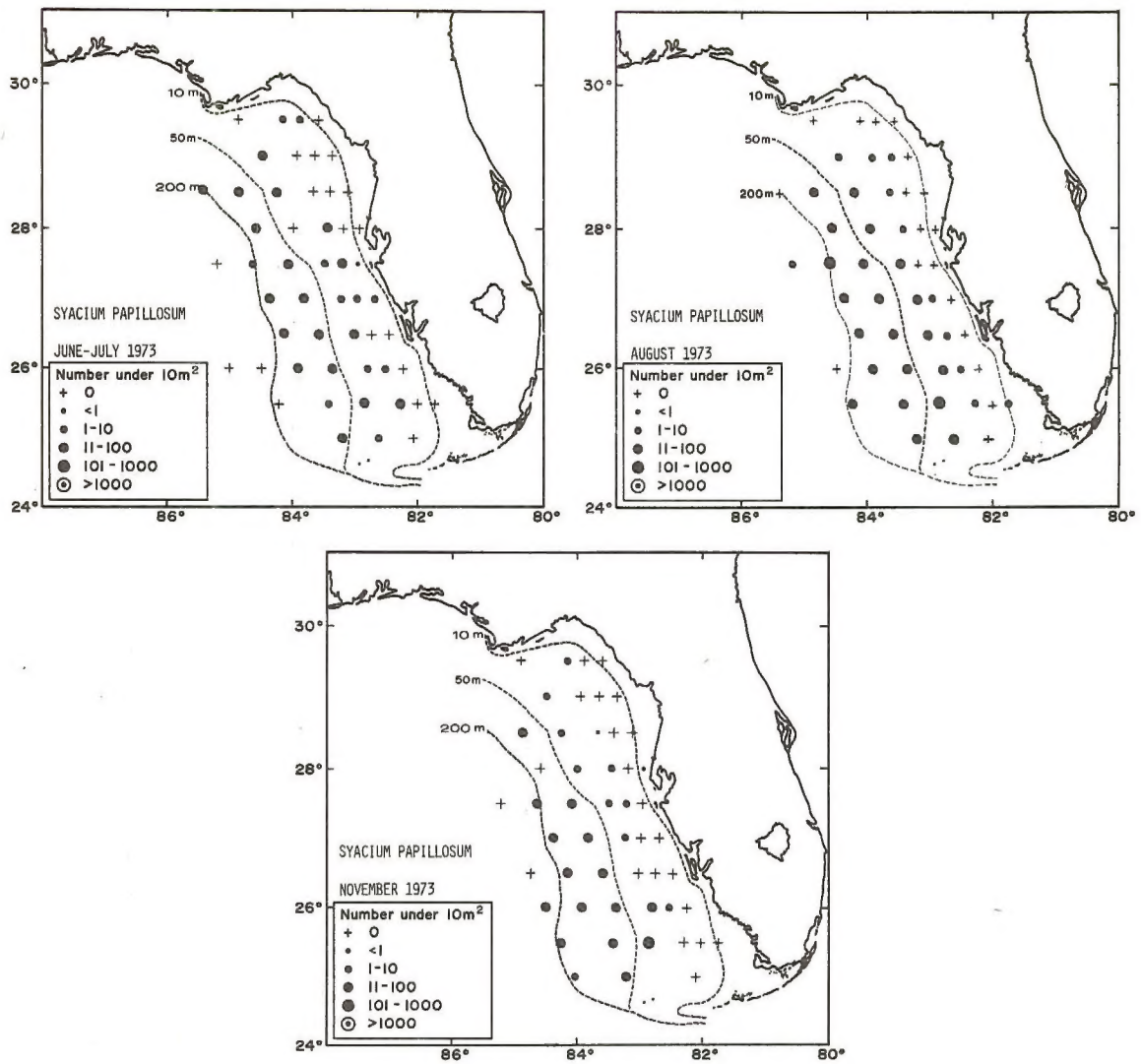


Fig. 147

Cont.

BOTHUS ROBINSI

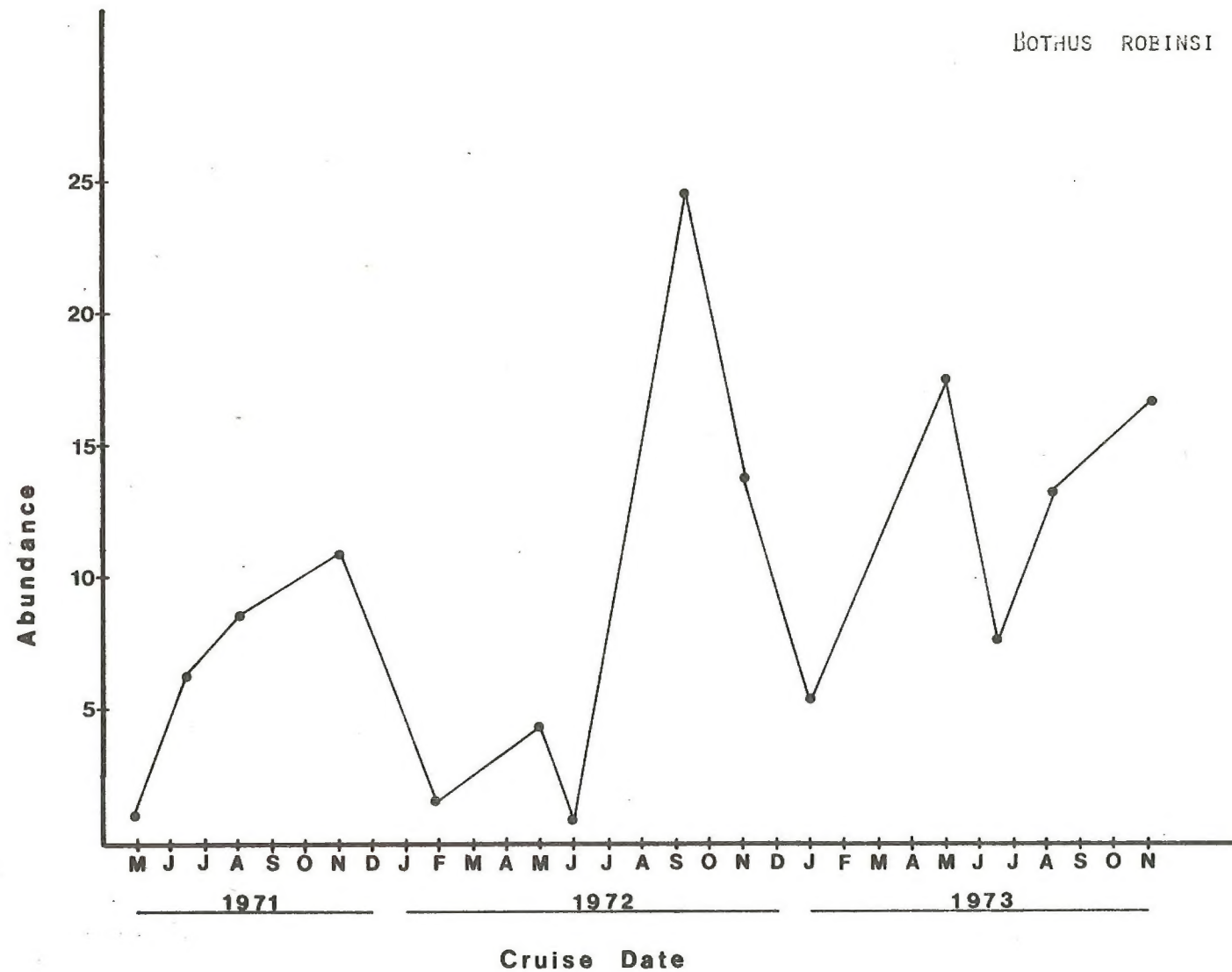


Fig. 148 Estimated mean abundances (number under 10 m² of sea surface) of *Bothus robbinsi* larvae in the eastern Gulf of Mexico, 1971-1974.

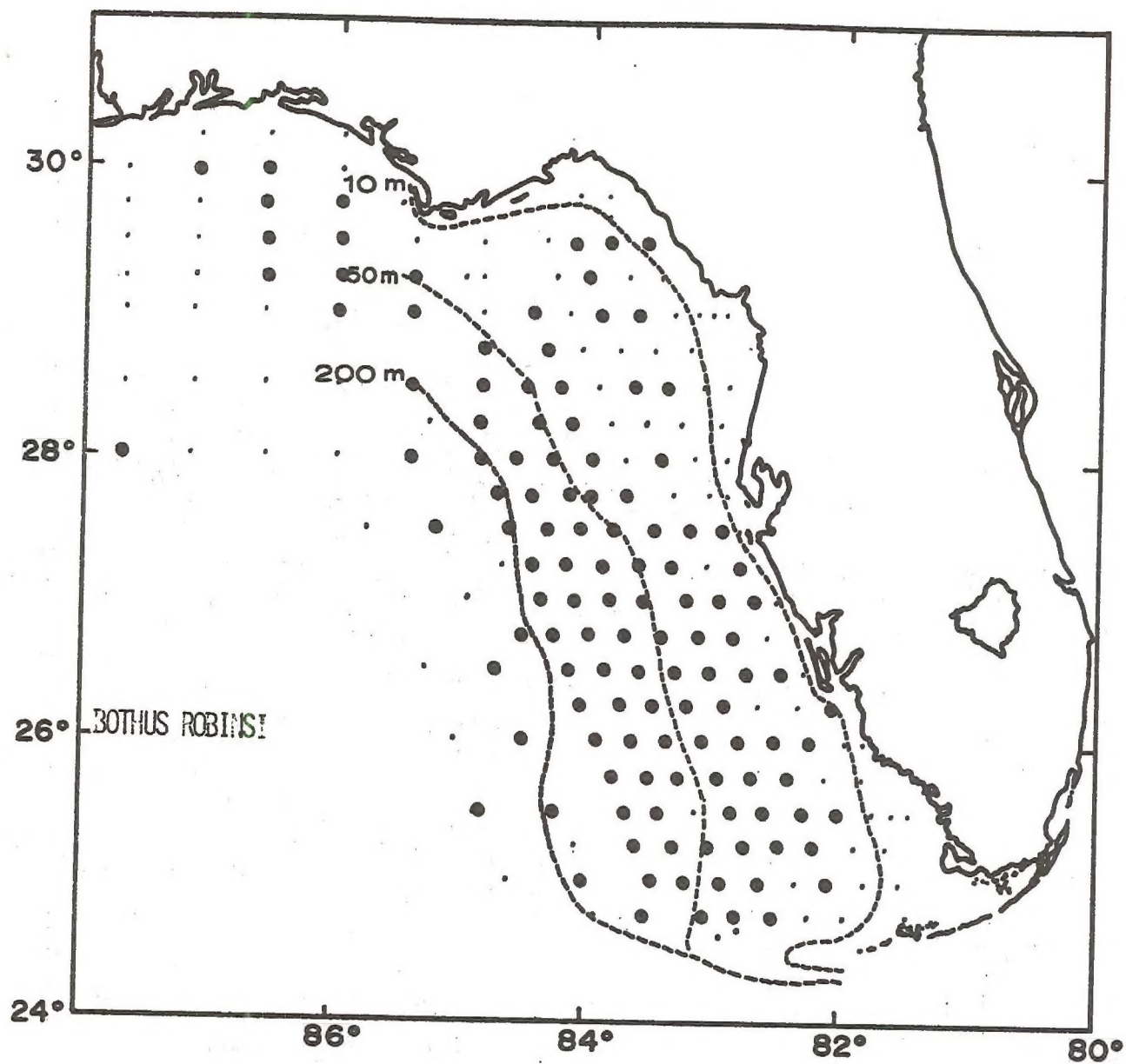


Fig. 149 Stations at which *Bothus robinsi* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

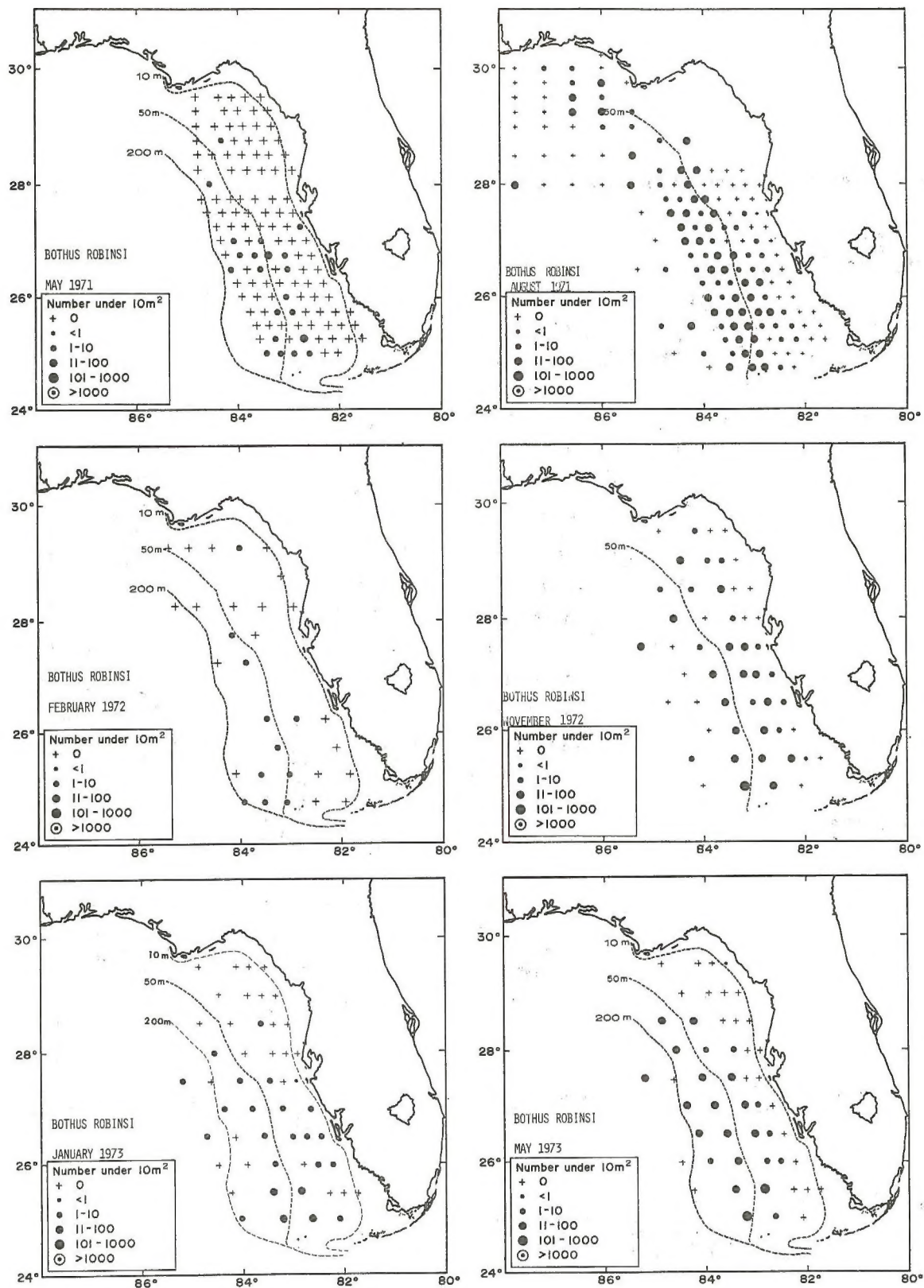


Fig. 150 Distribution and abundance of *Bothus robinsoni* larvae in the eastern Gulf of Mexico, 1971-1974.

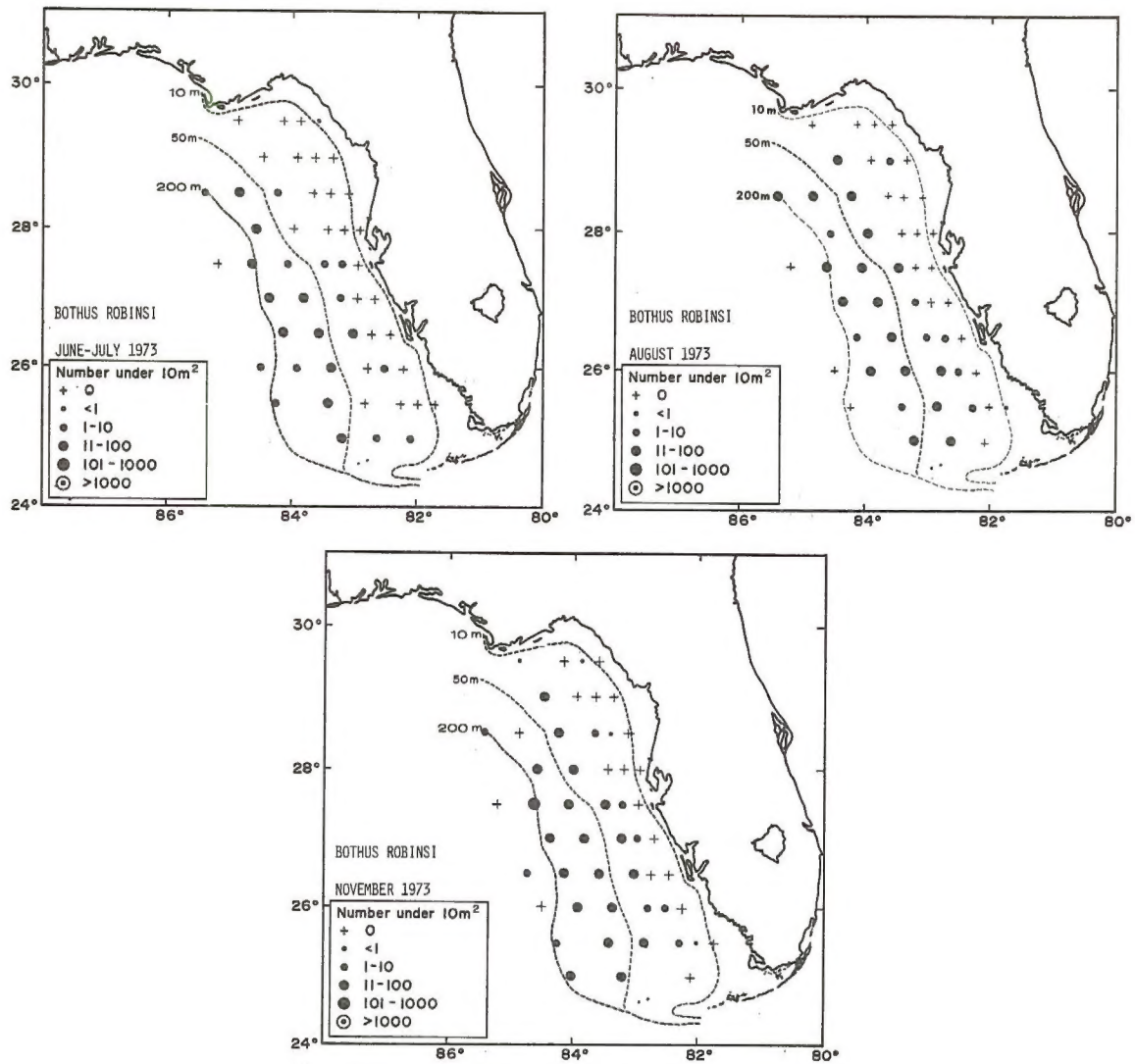


Fig. 150

Cont.

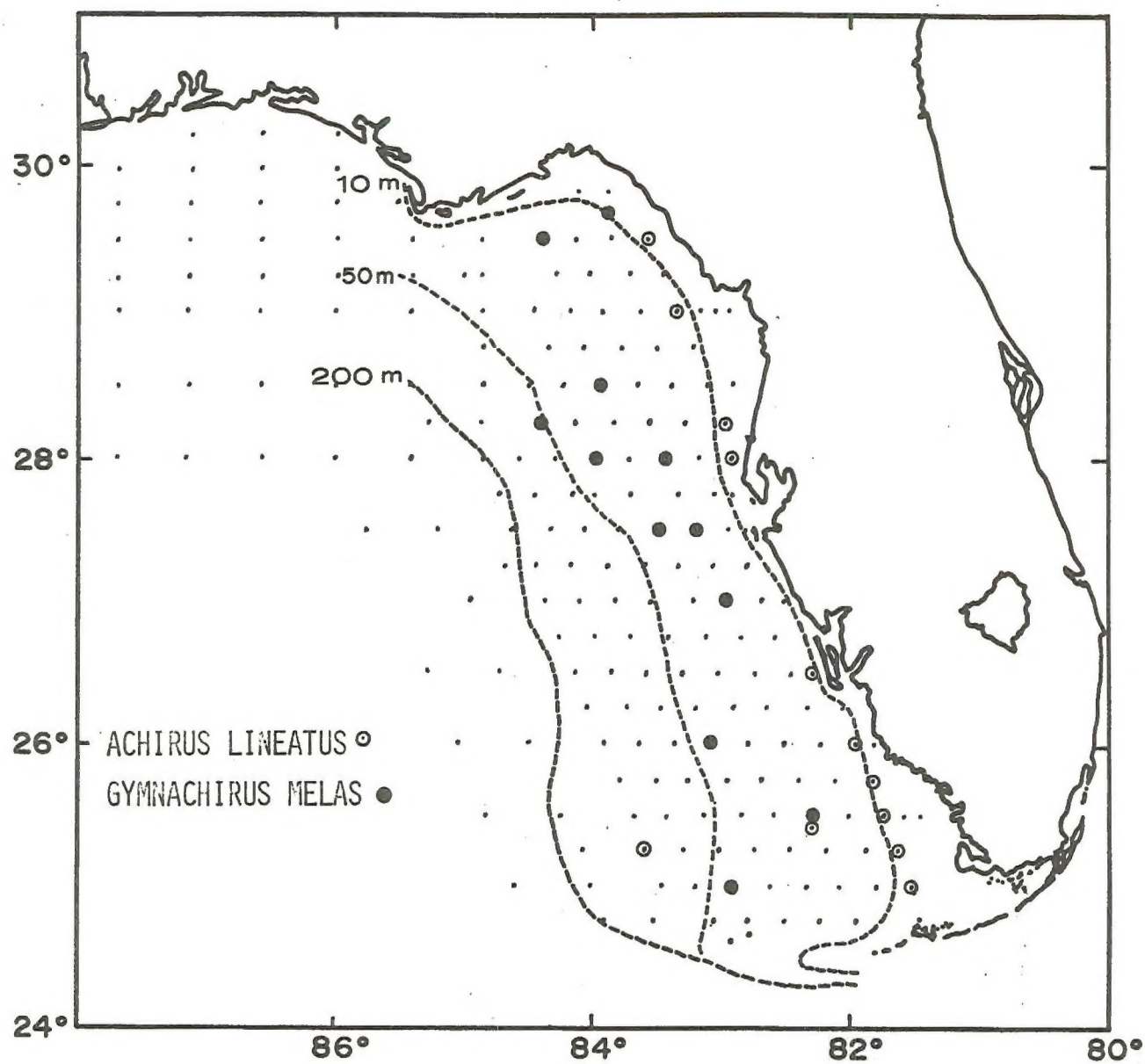


Fig 151

Stations at which *Achirus lineatus* and *Gymnachirus melas* larvae occurred at least once during 17 cruises to the eastern Gulf of Mexico, 1971-1974.

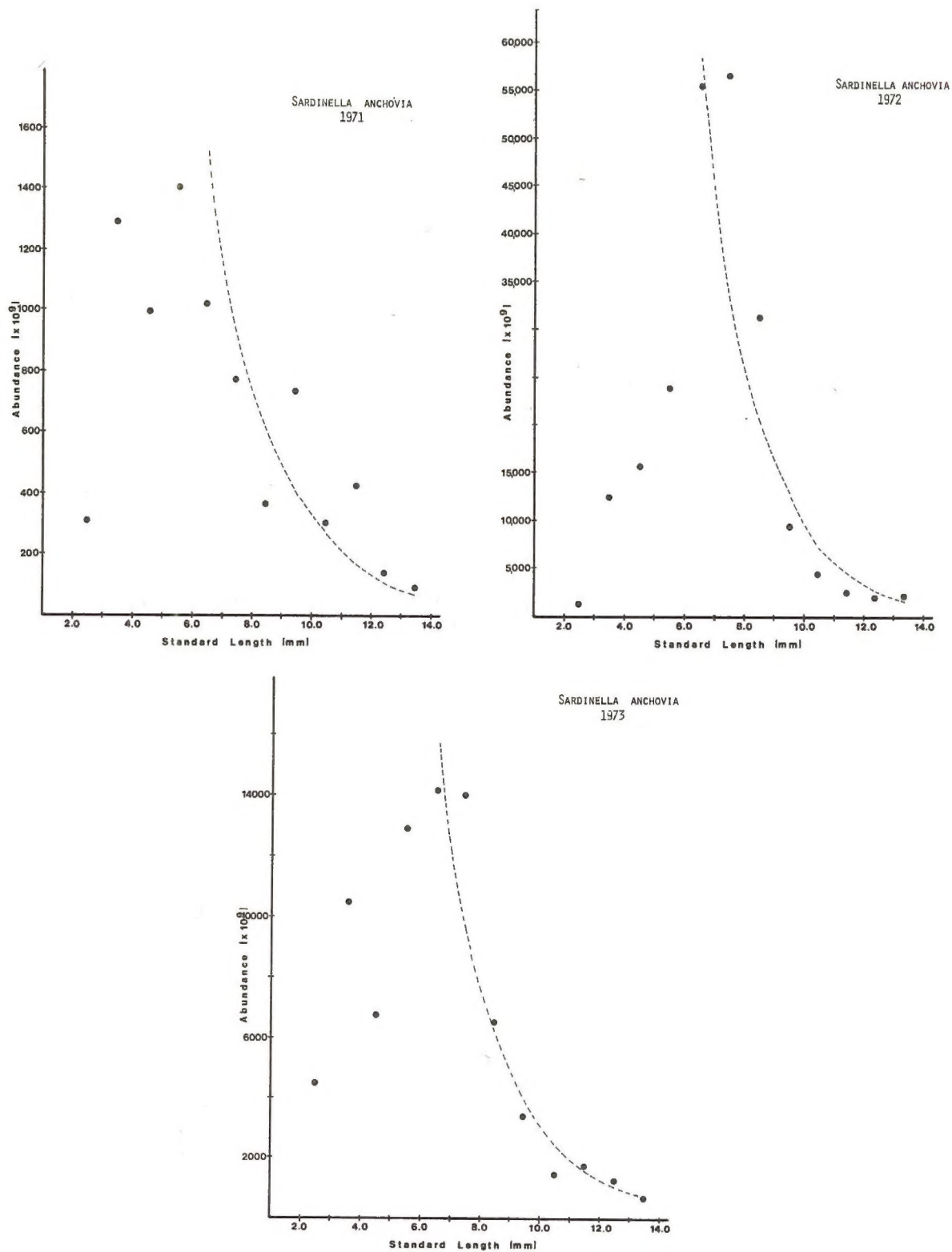


Fig. 152 Apparent mortality rates of *Sardinella anchovia* larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

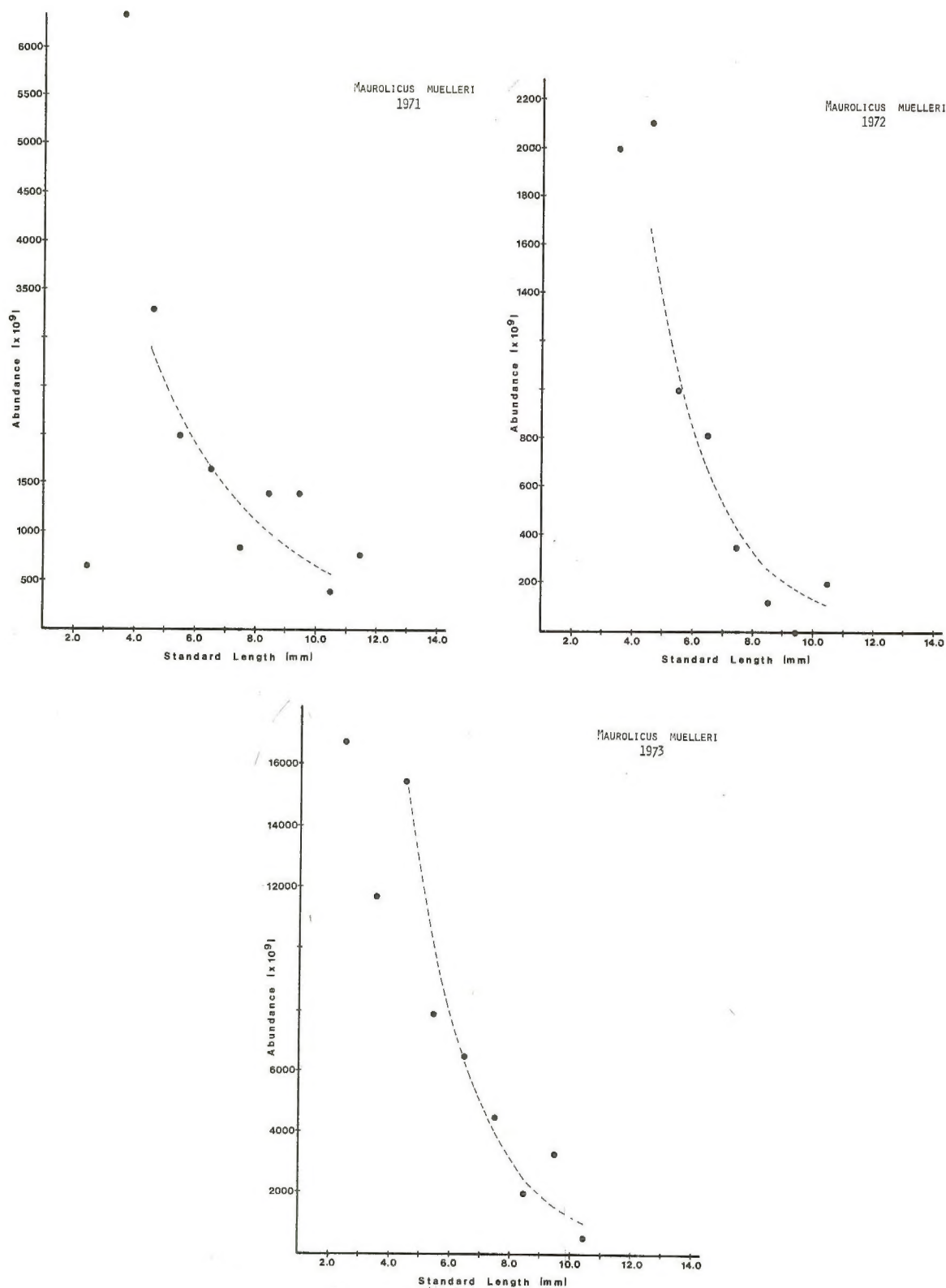


Fig. 153 Apparent mortality rates of Maurolicus muelleri larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

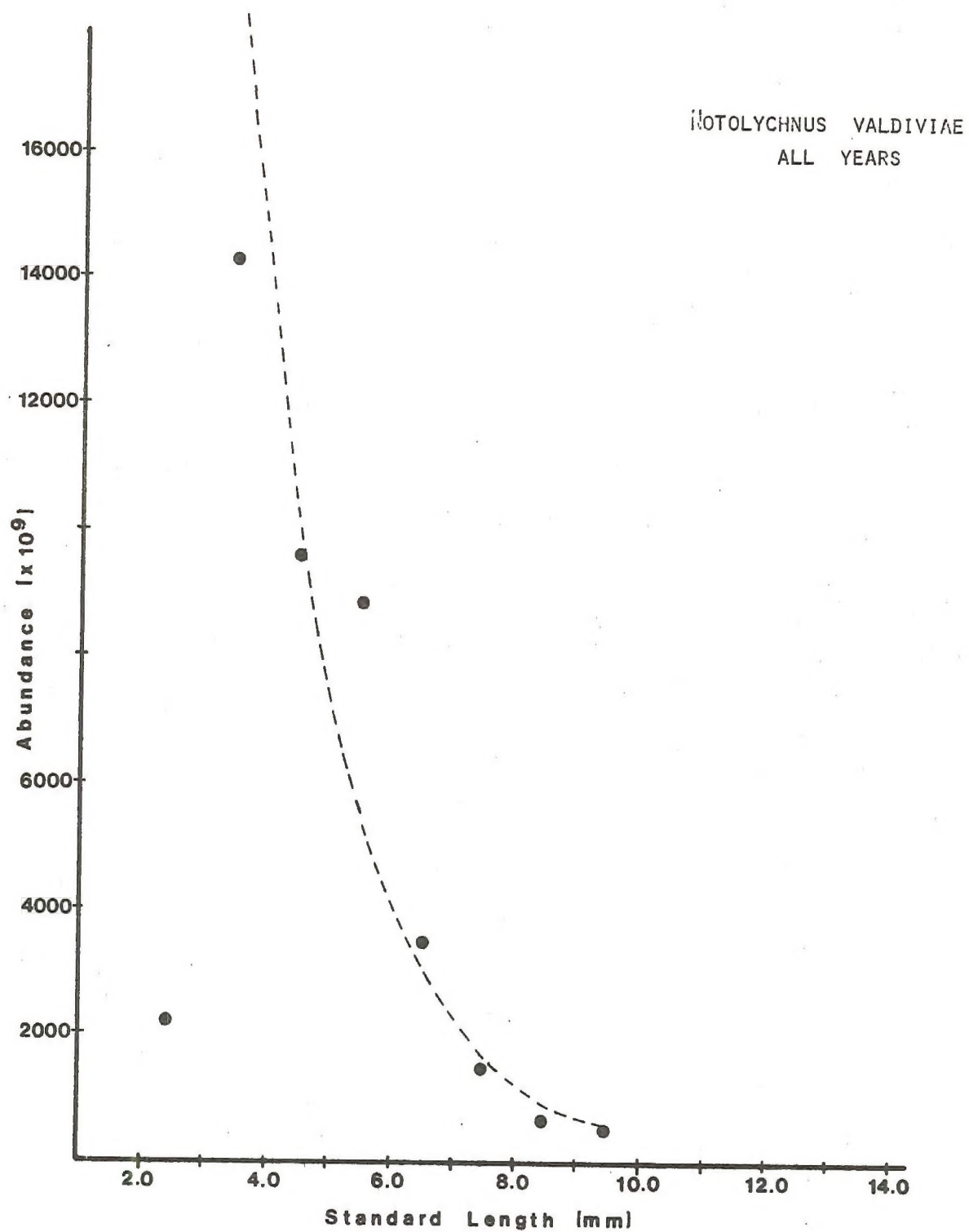


Fig. 154 Apparent mortality rate of *Notolychnus valdiviae* larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

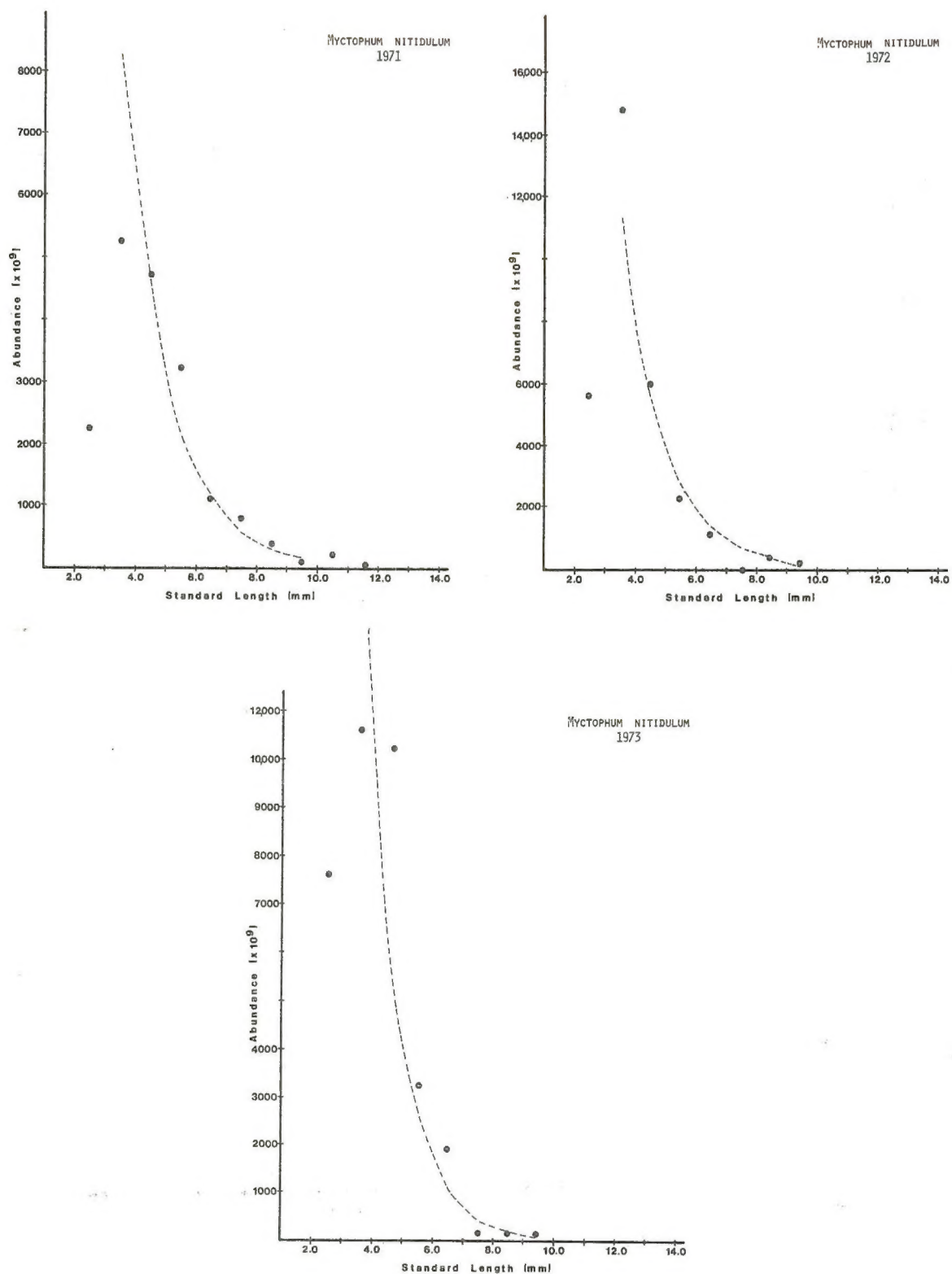


Fig. 155

Apparent mortality rates of Myctophum nitidulum larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

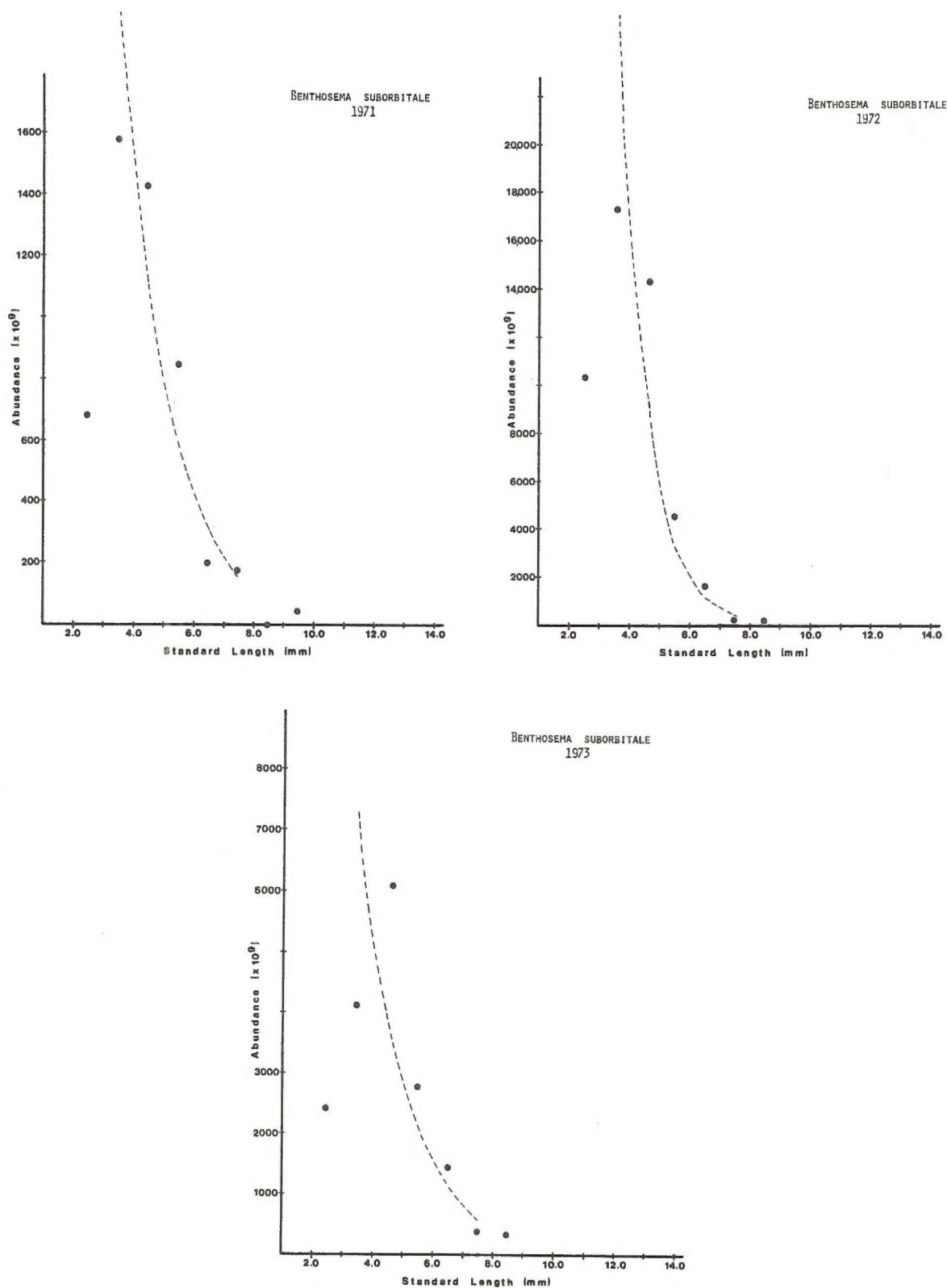


Fig. 156

Apparent mortality rates of Benthosema suborbitale larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

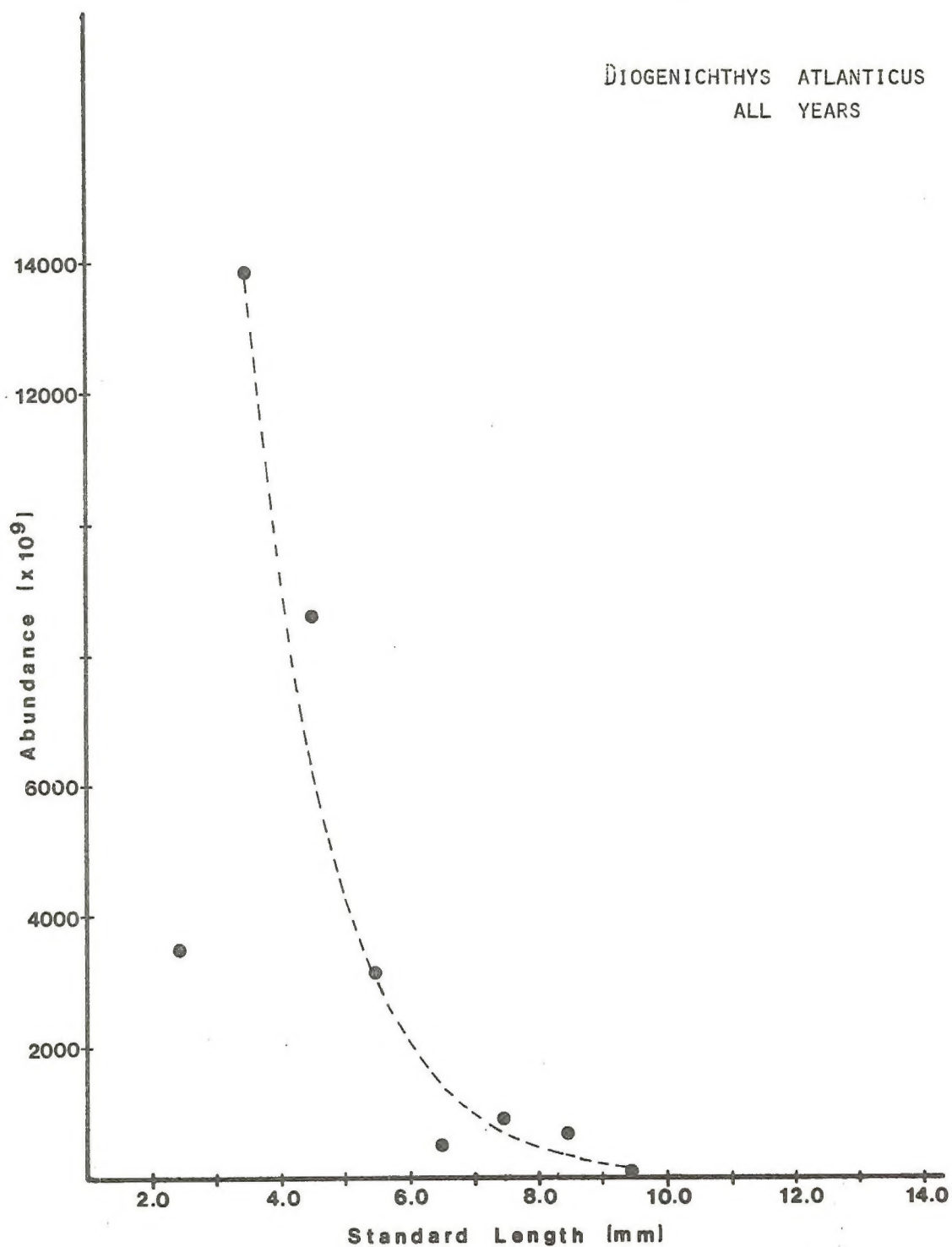


Fig. 157

Apparent mortality rate of Diogenichthys atlanticus larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

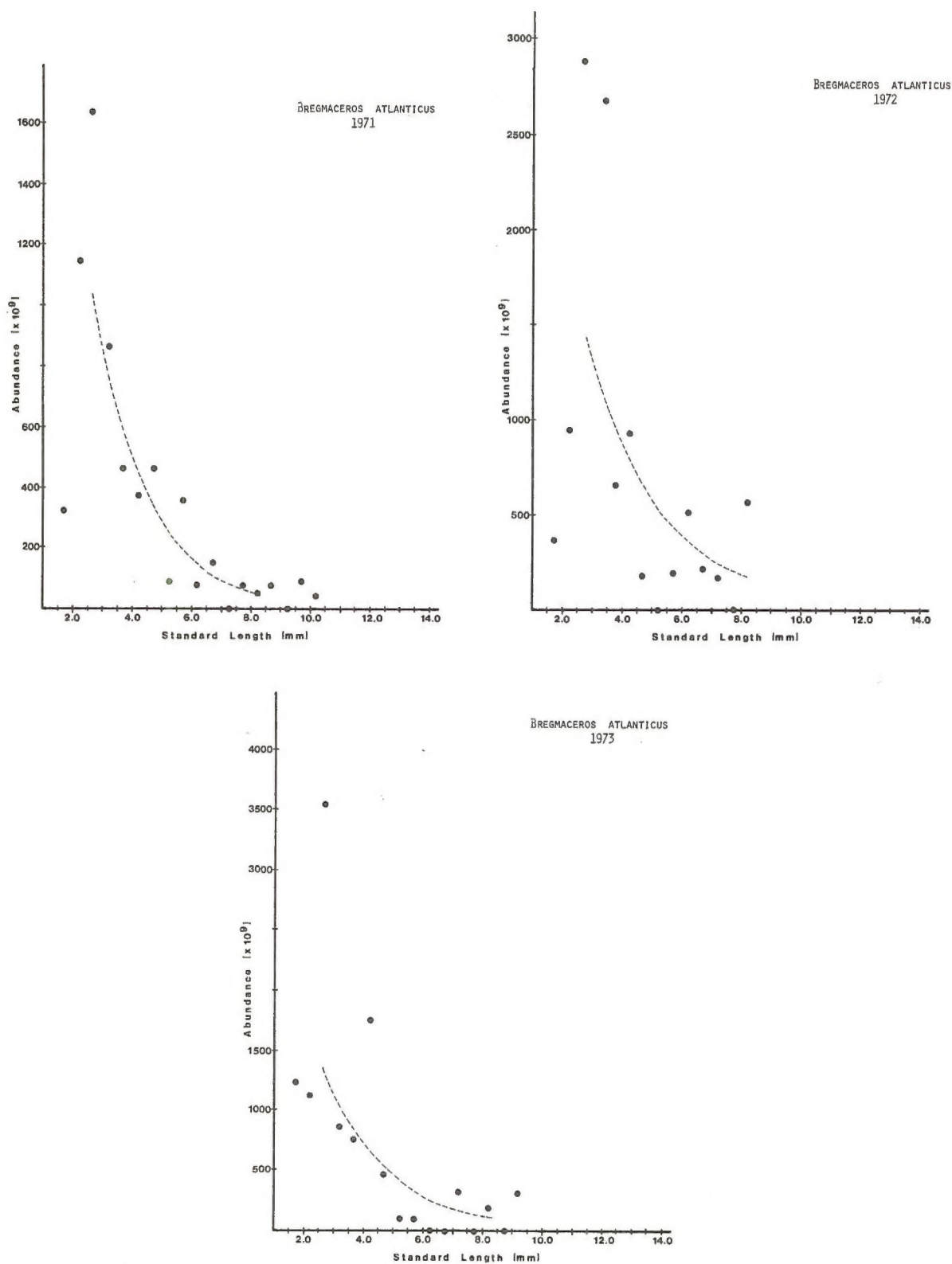


Fig. 158

Apparent mortality rates of Bregmaceros atlanticus larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

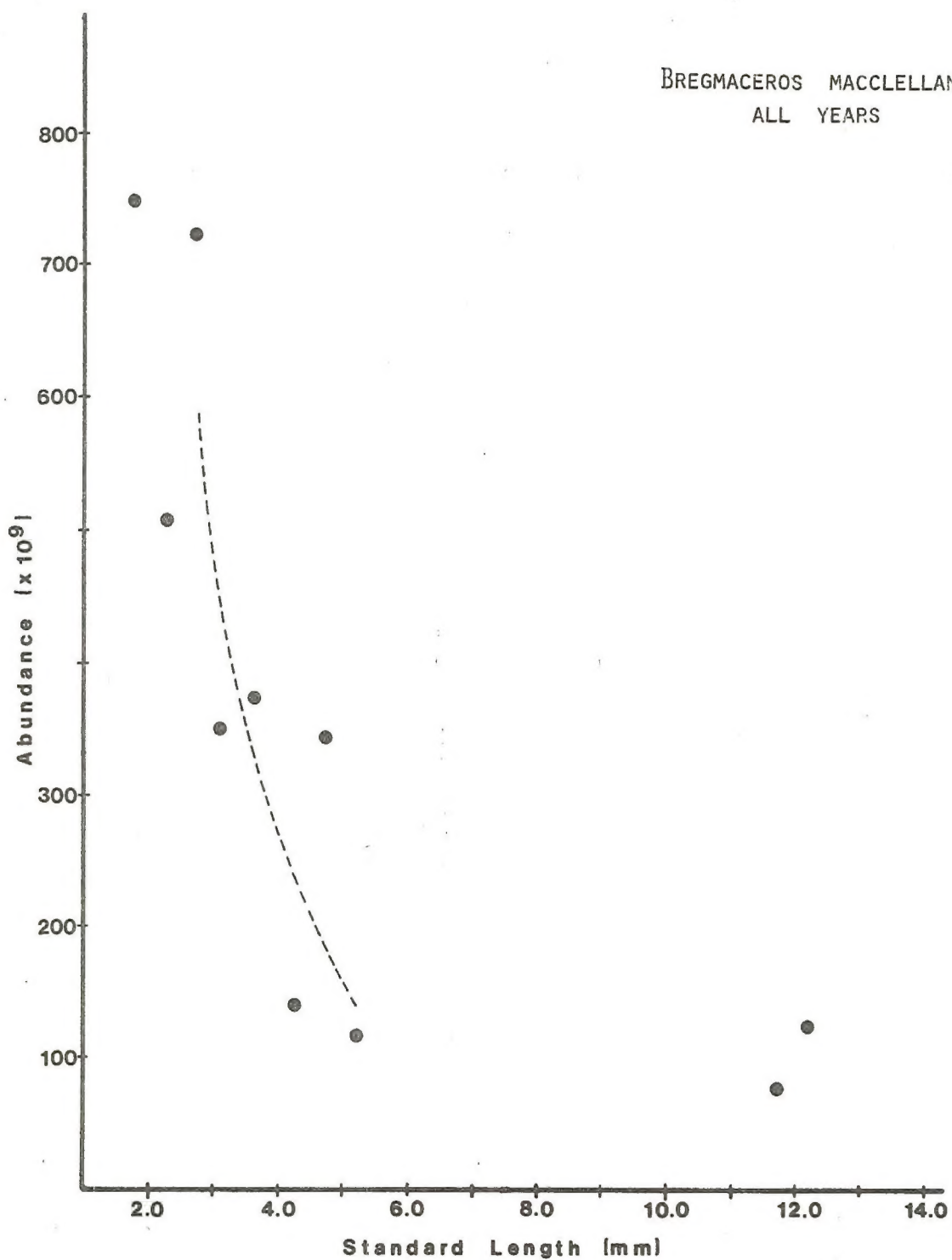


Fig. 159 Apparent mortality rate of Bregmaceros maclellandi larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

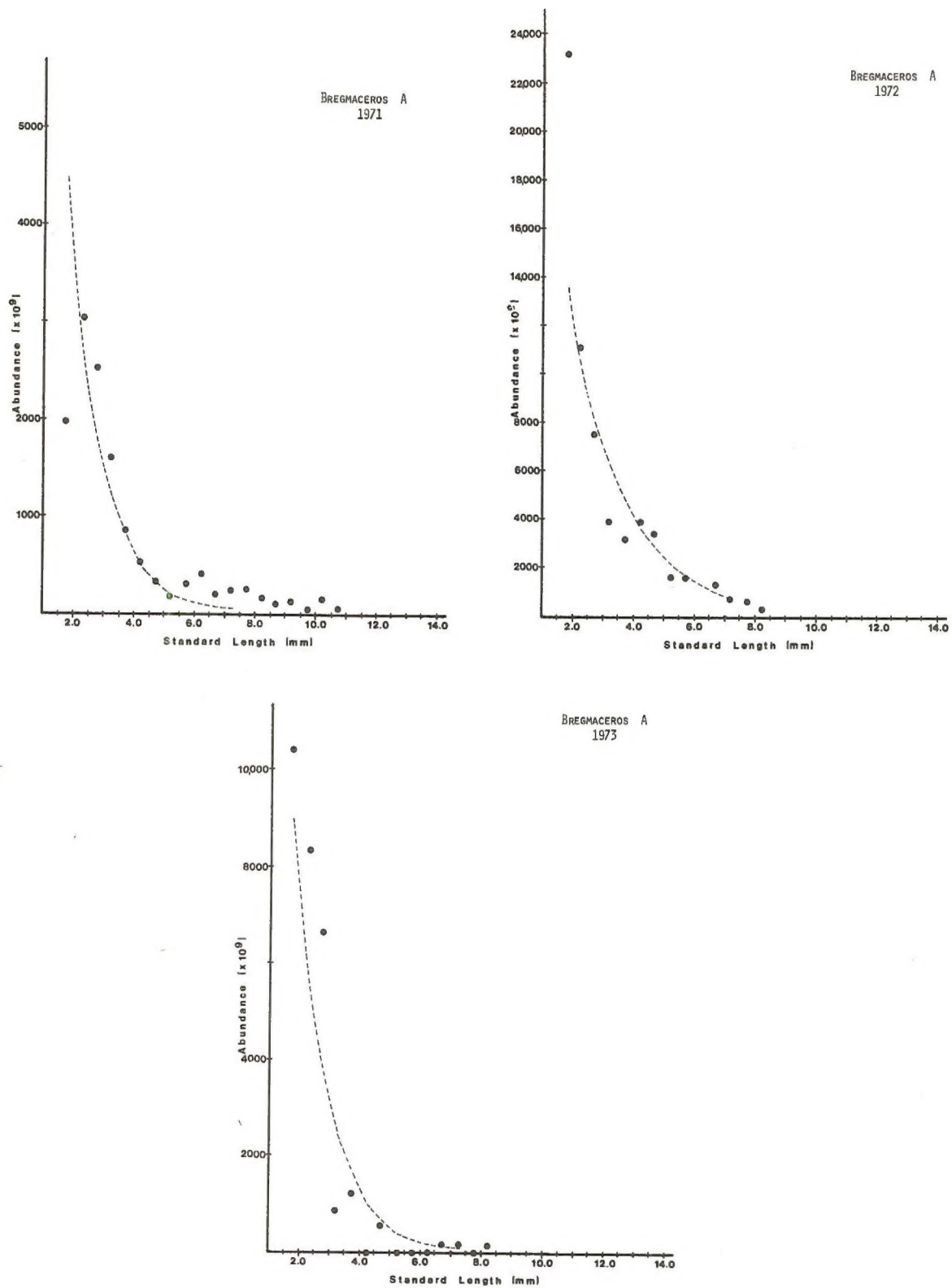


Fig. 160

Apparent mortality rates of Bregmaceros Type A larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

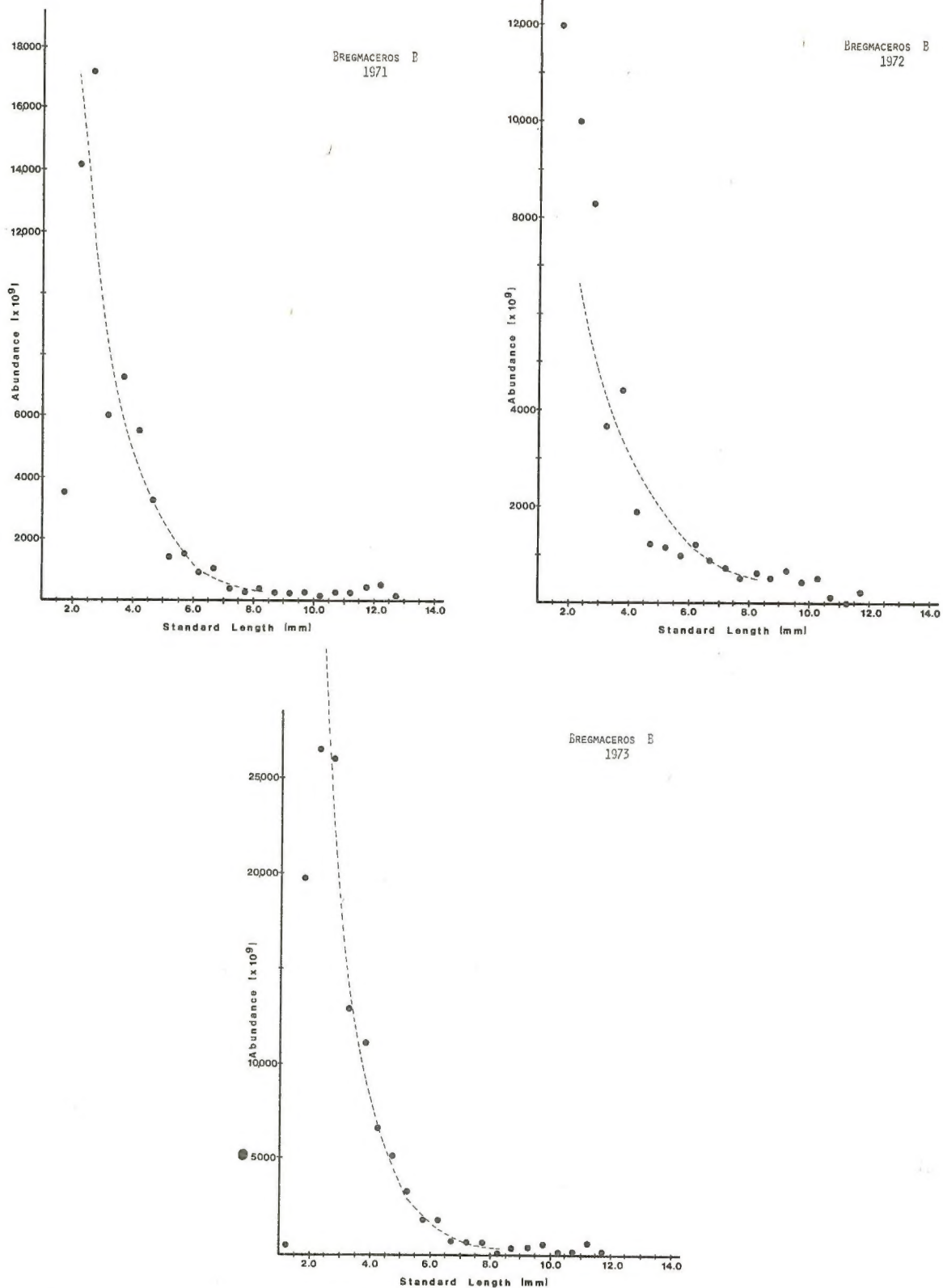


Fig. 161

Apparent mortality rates of Bregmaceros Type B larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

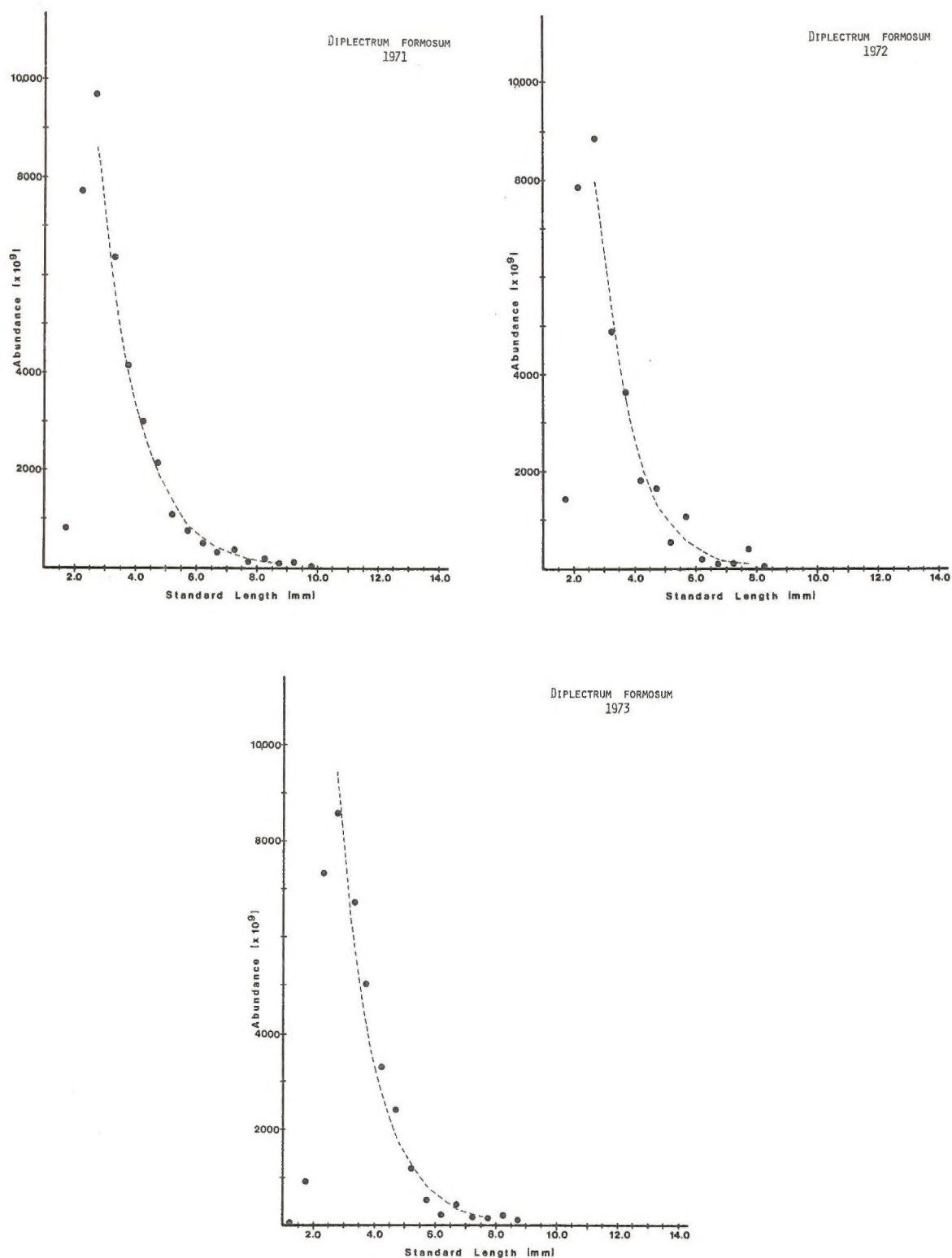


Fig. 162

Apparent mortality rates of Diplectrum formosum larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

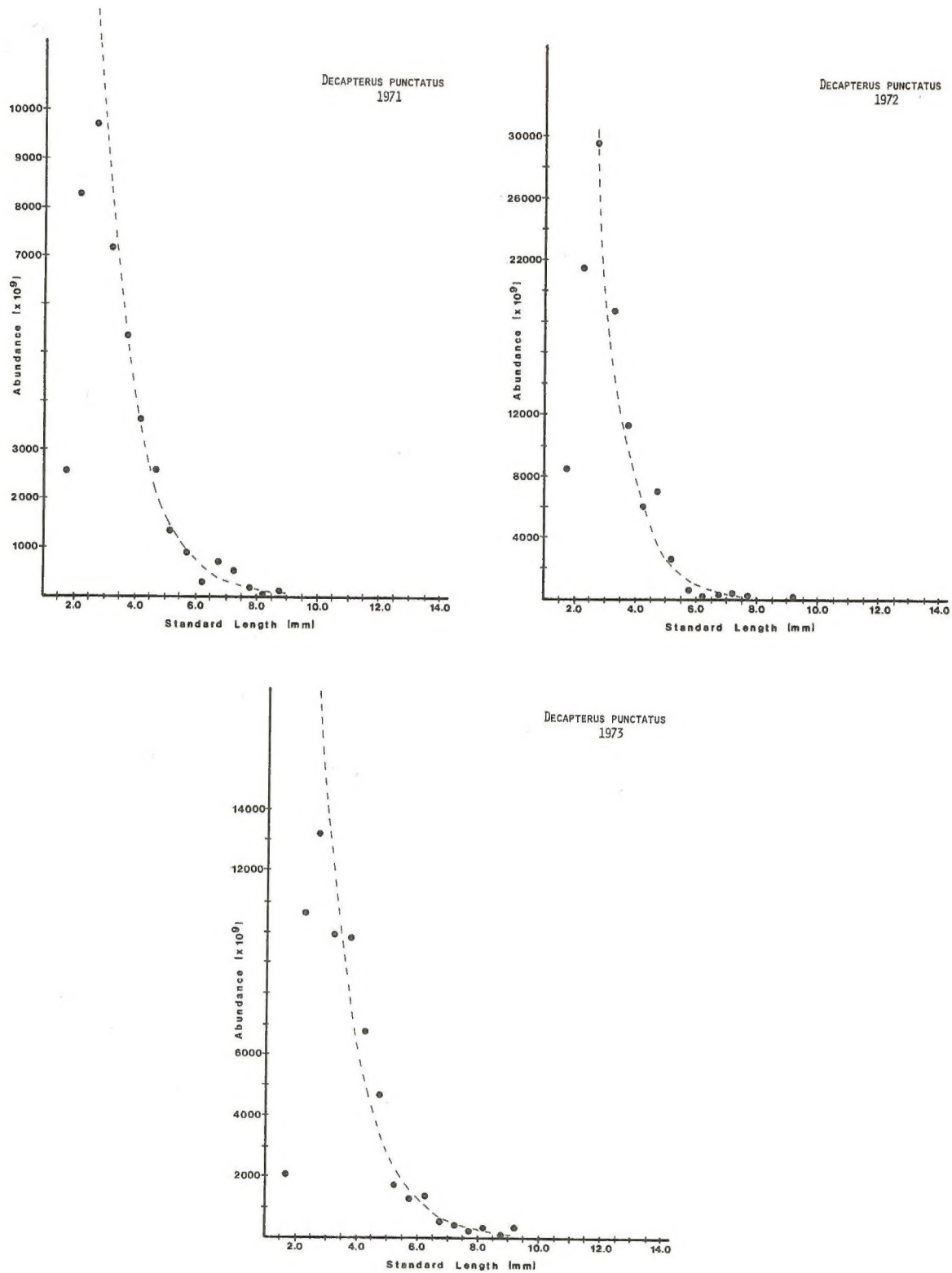


Fig. 163

Apparent mortality rates of Decapterus punctatus larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

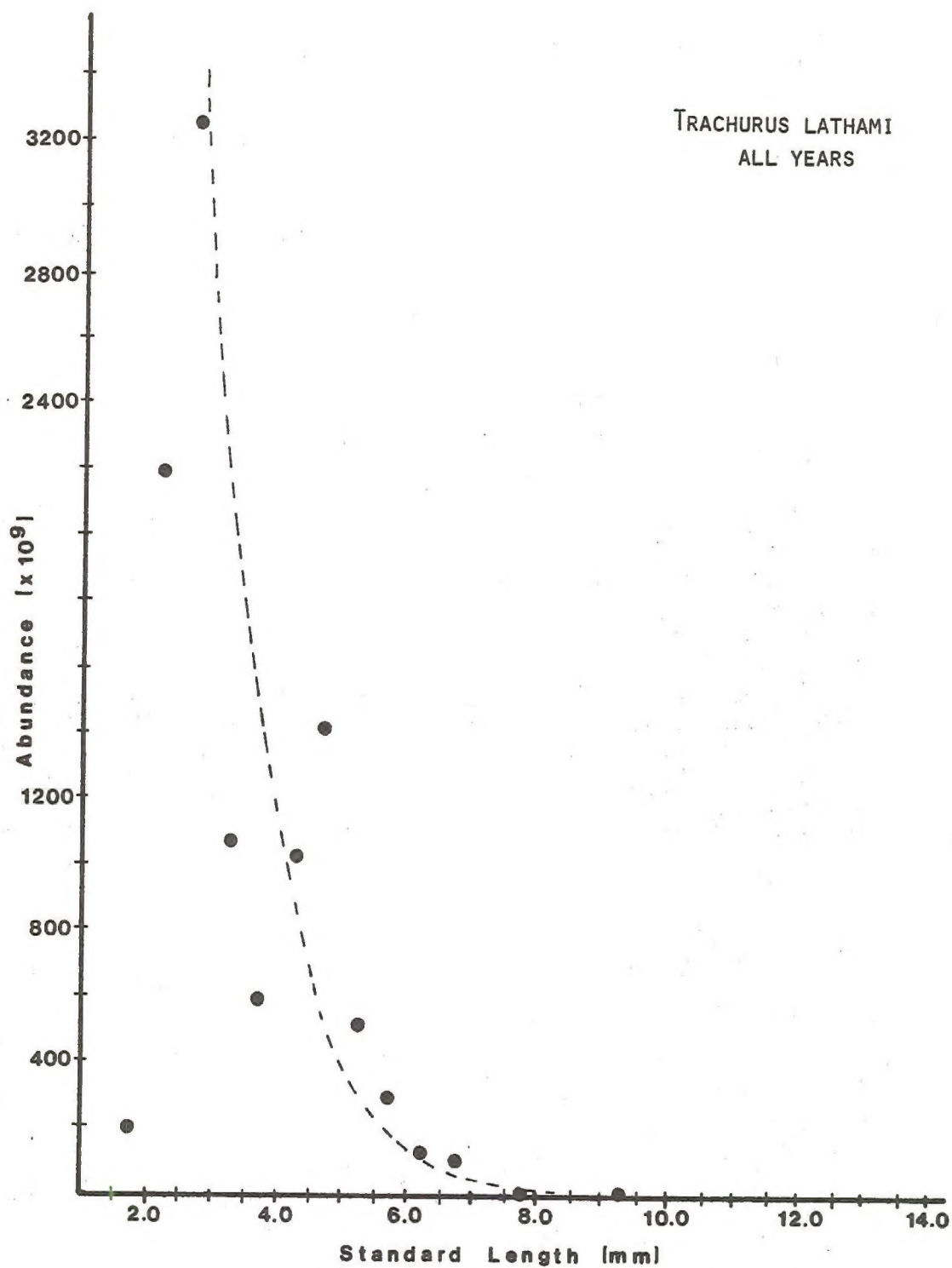


Fig. 164 Apparent mortality rate of *Trachurus lathami* larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

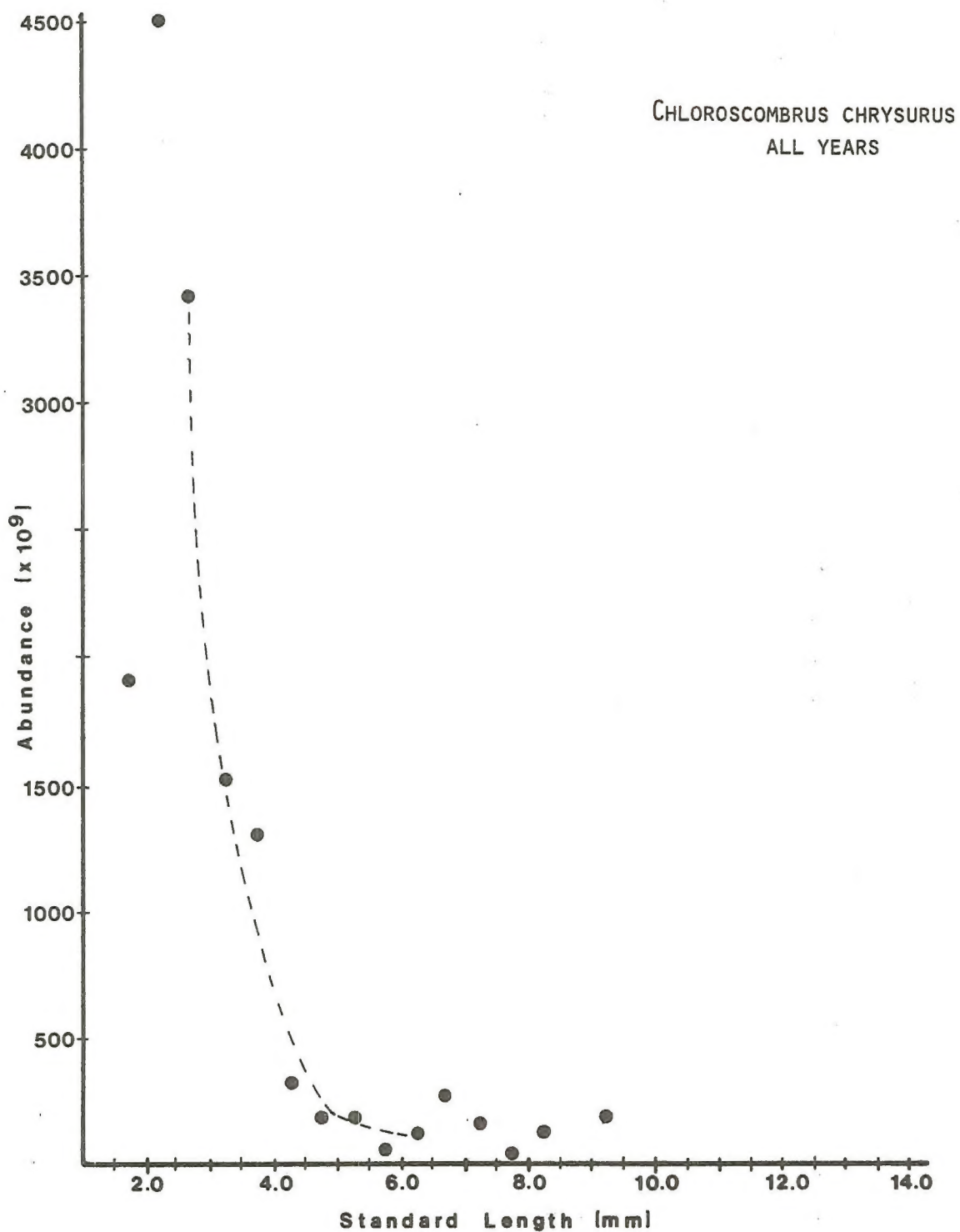


Fig. 165 Apparent mortality rate of Chloroscombrus chrysurus larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

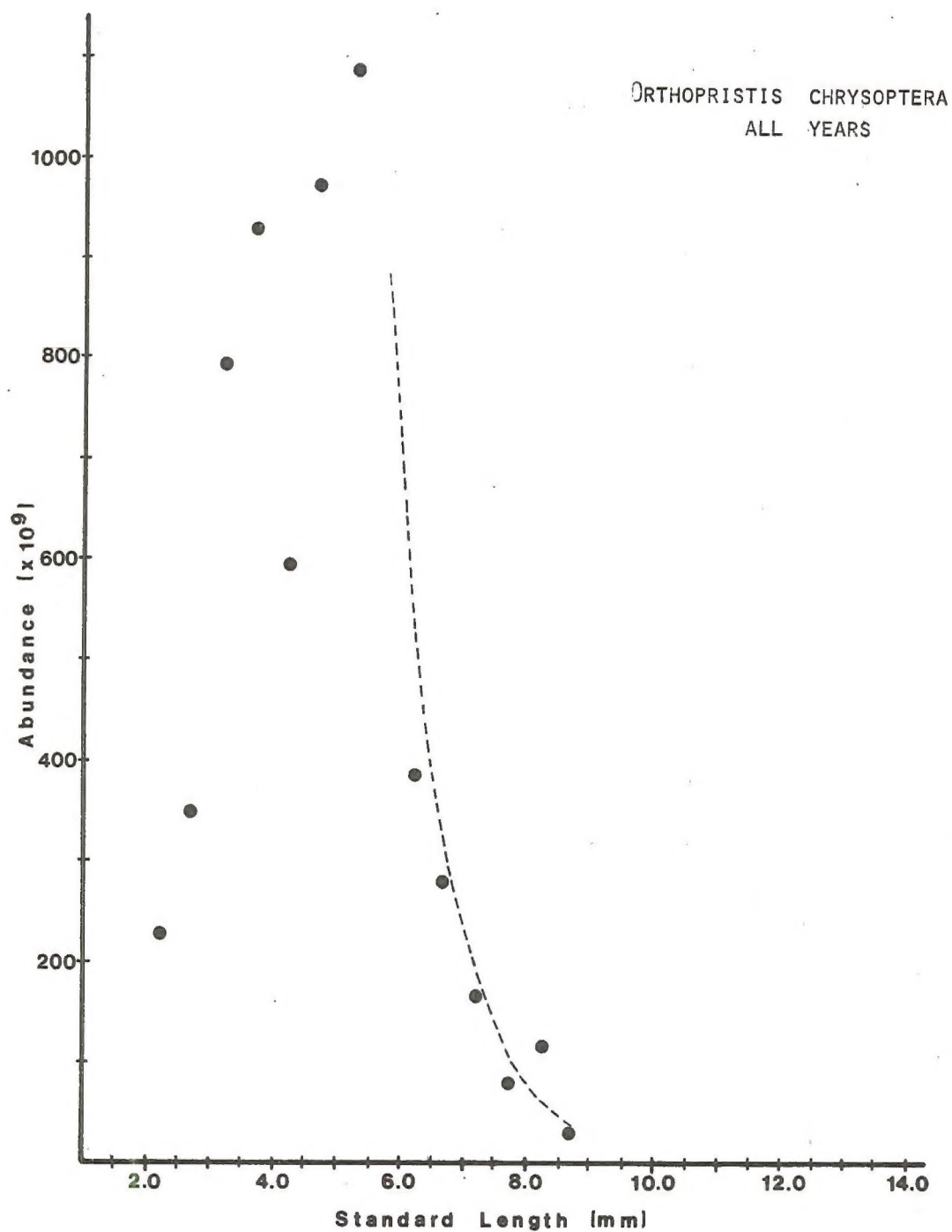


Fig. 166 Apparent mortality rate of *Orthopristis chrysoptera* larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

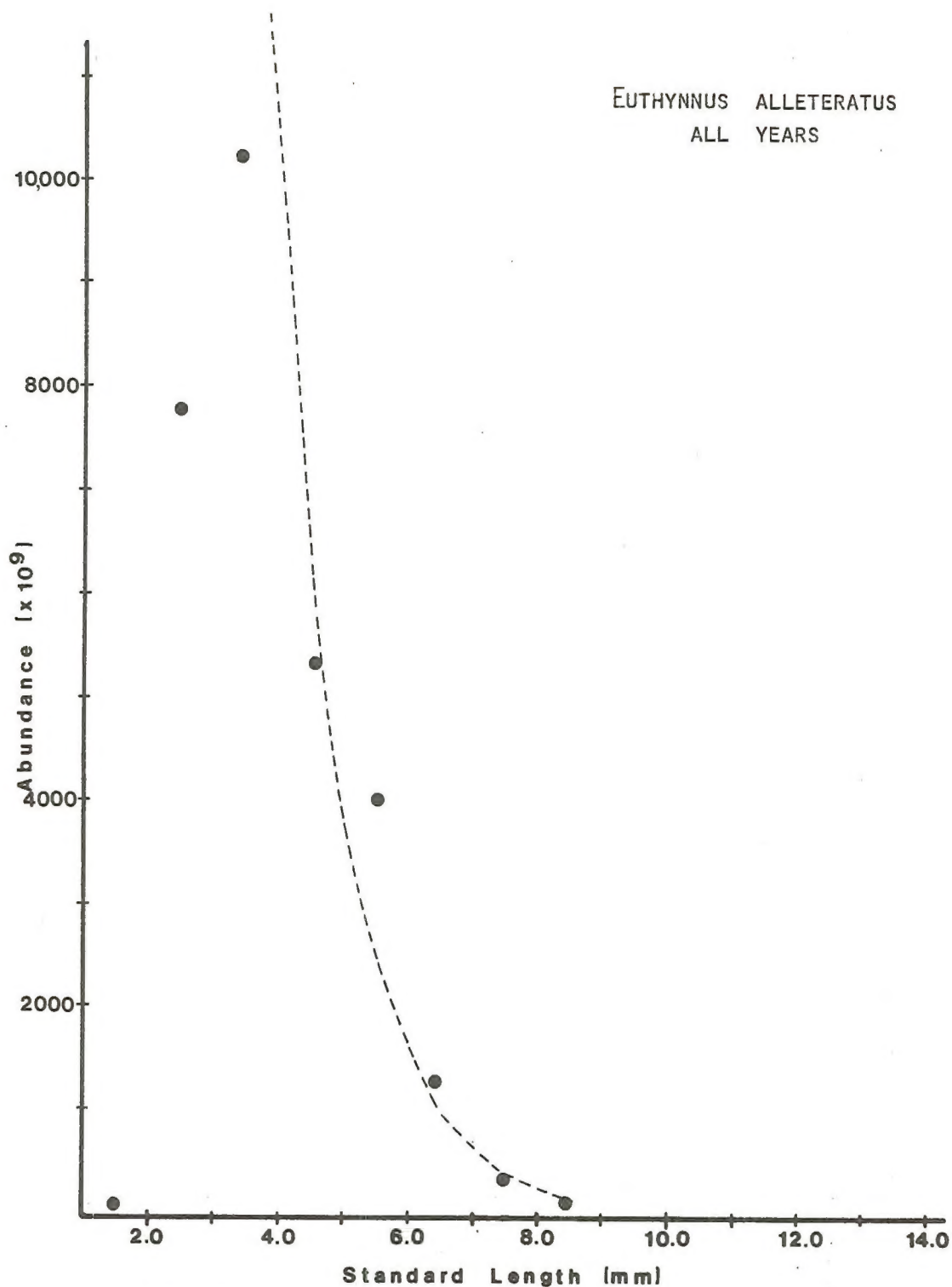


Fig. 167 Apparent mortality rate of Euthynnus alletteratus larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

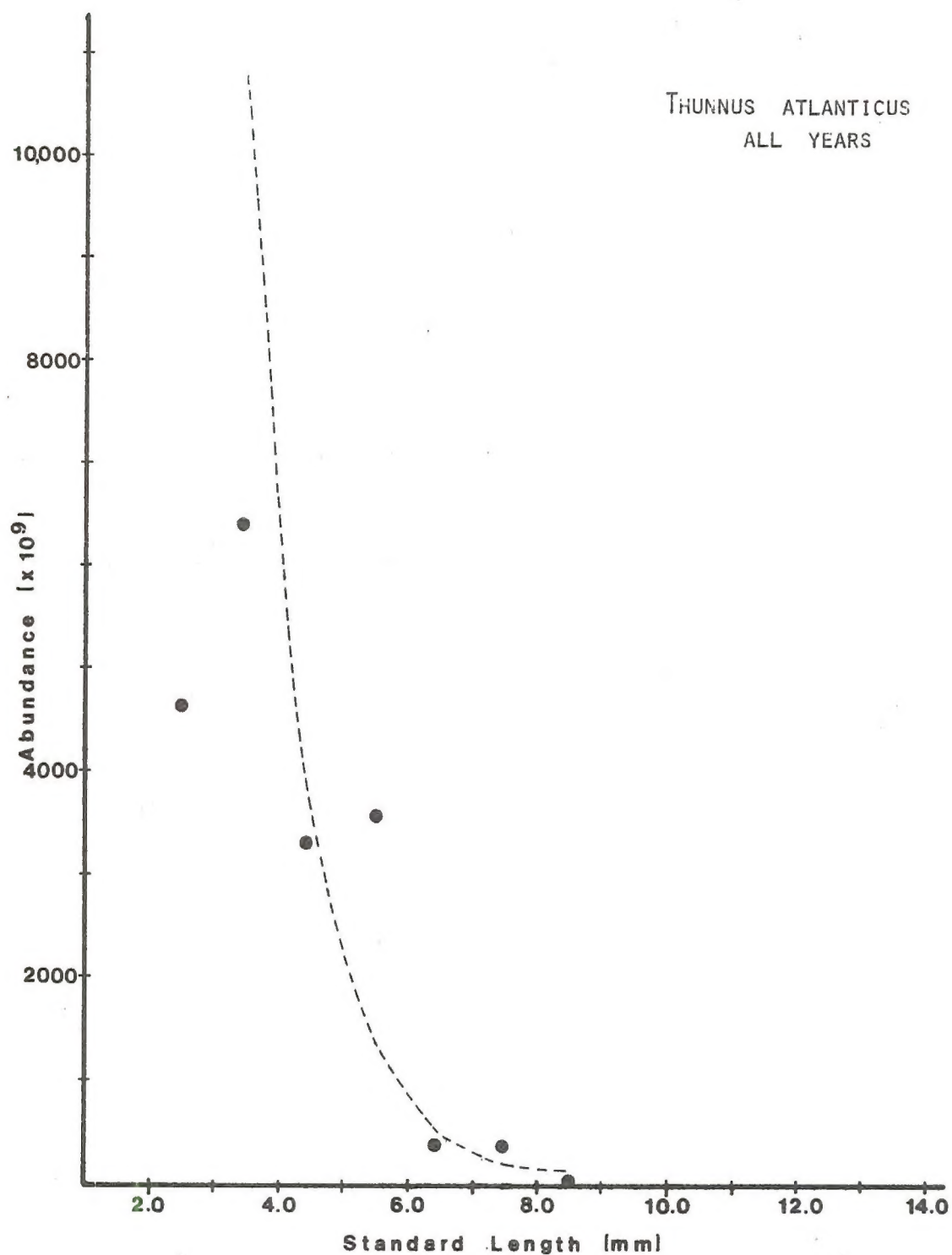


Fig. 168 Apparent mortality rate of *Thunnus atlanticus* larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1973 data combined.

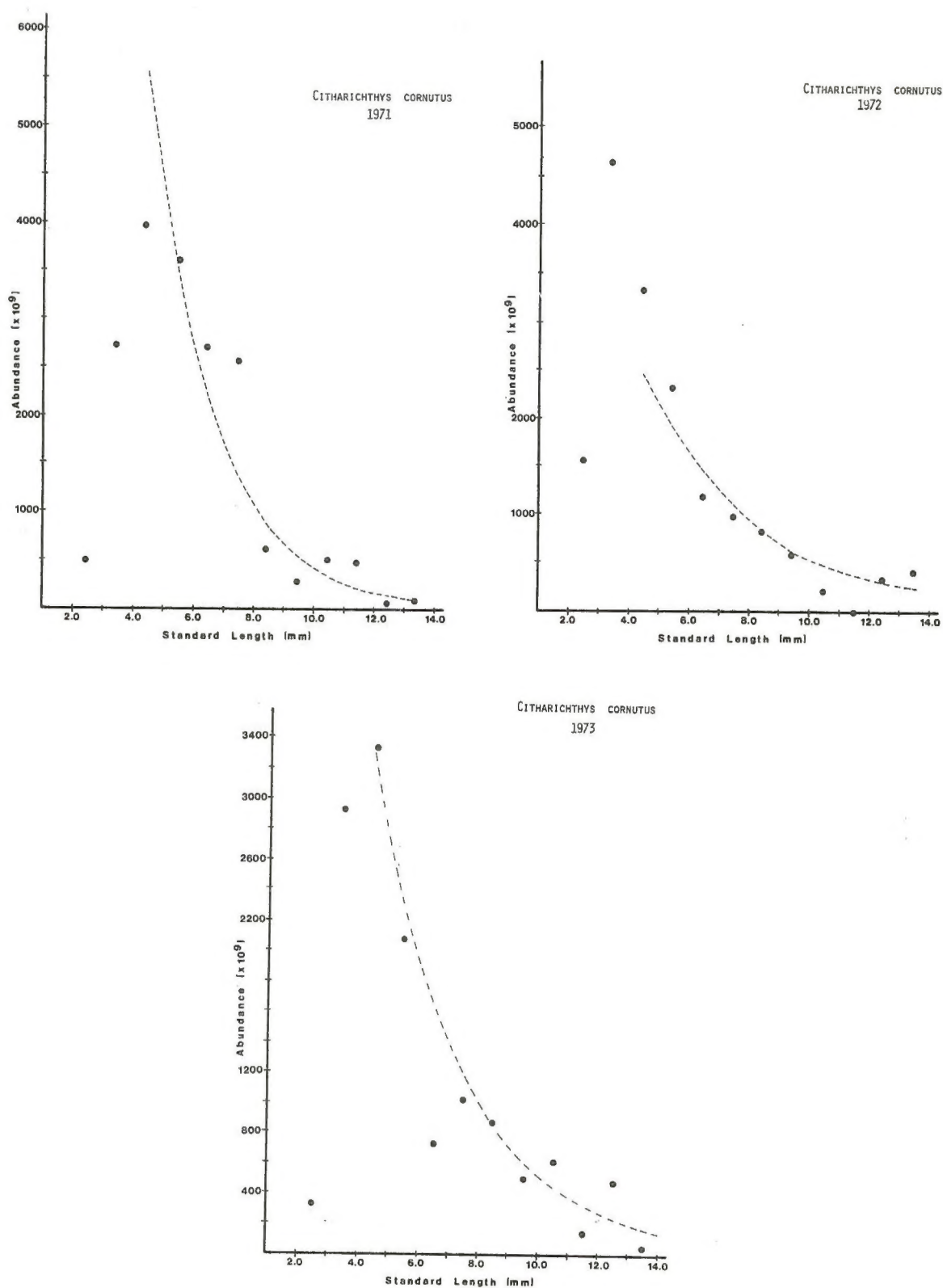


Fig. 169 Apparent mortality rates of *Citharichthys cornutus* larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

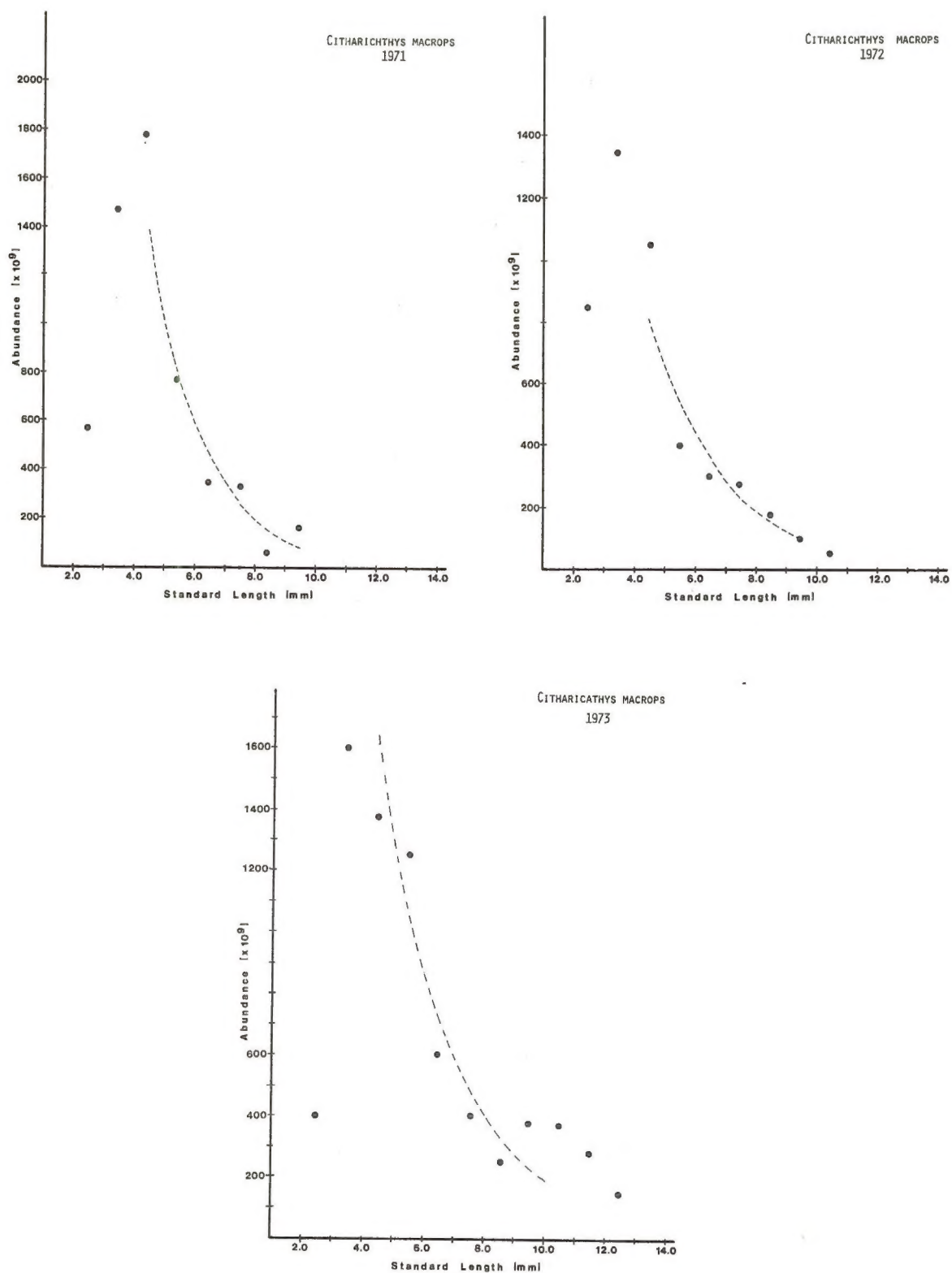


Fig. 170 Apparent mortality rates of Citharichthys macrops larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

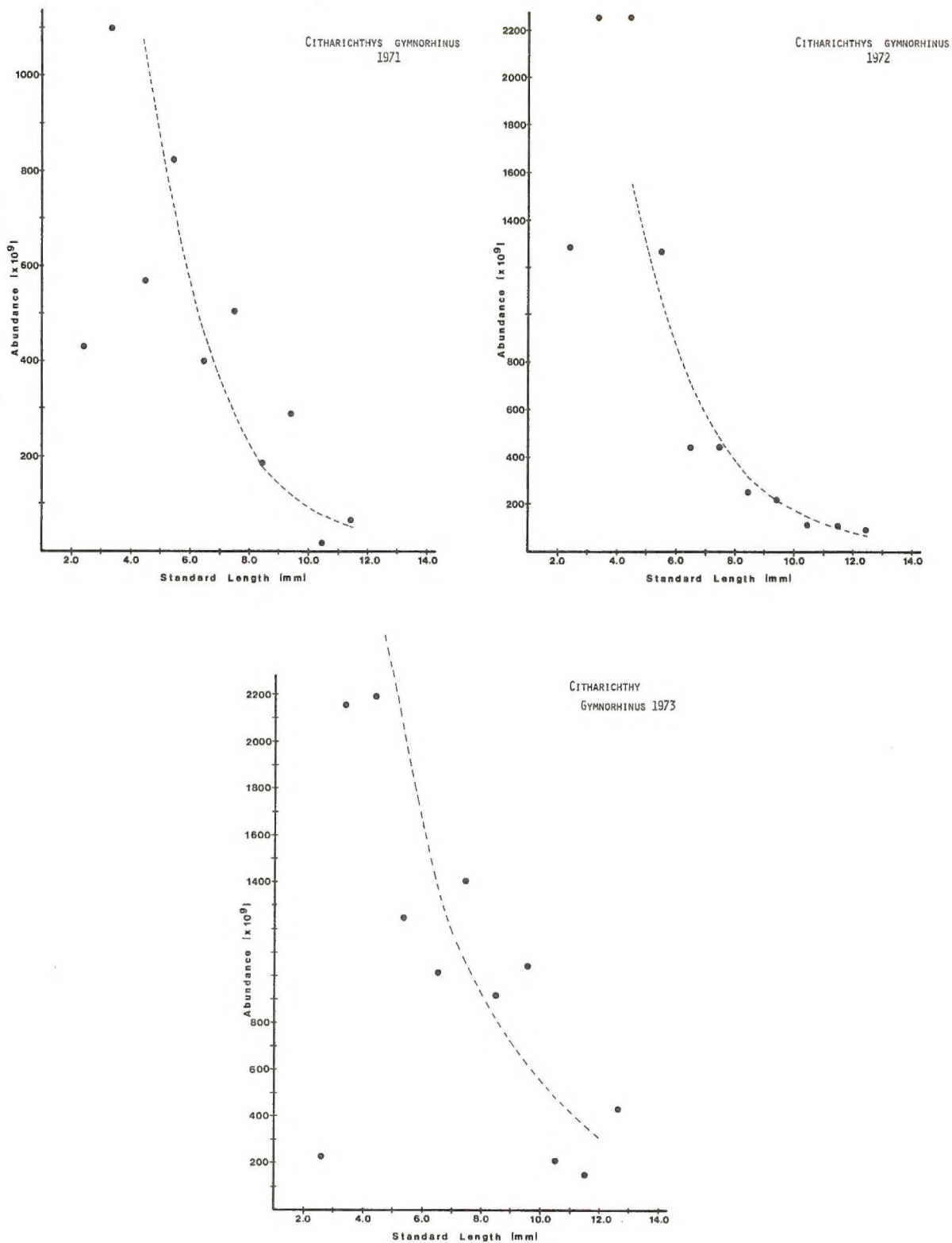


Fig. 171 Apparent mortality rates of *Citharichthys gymnorhinus* larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

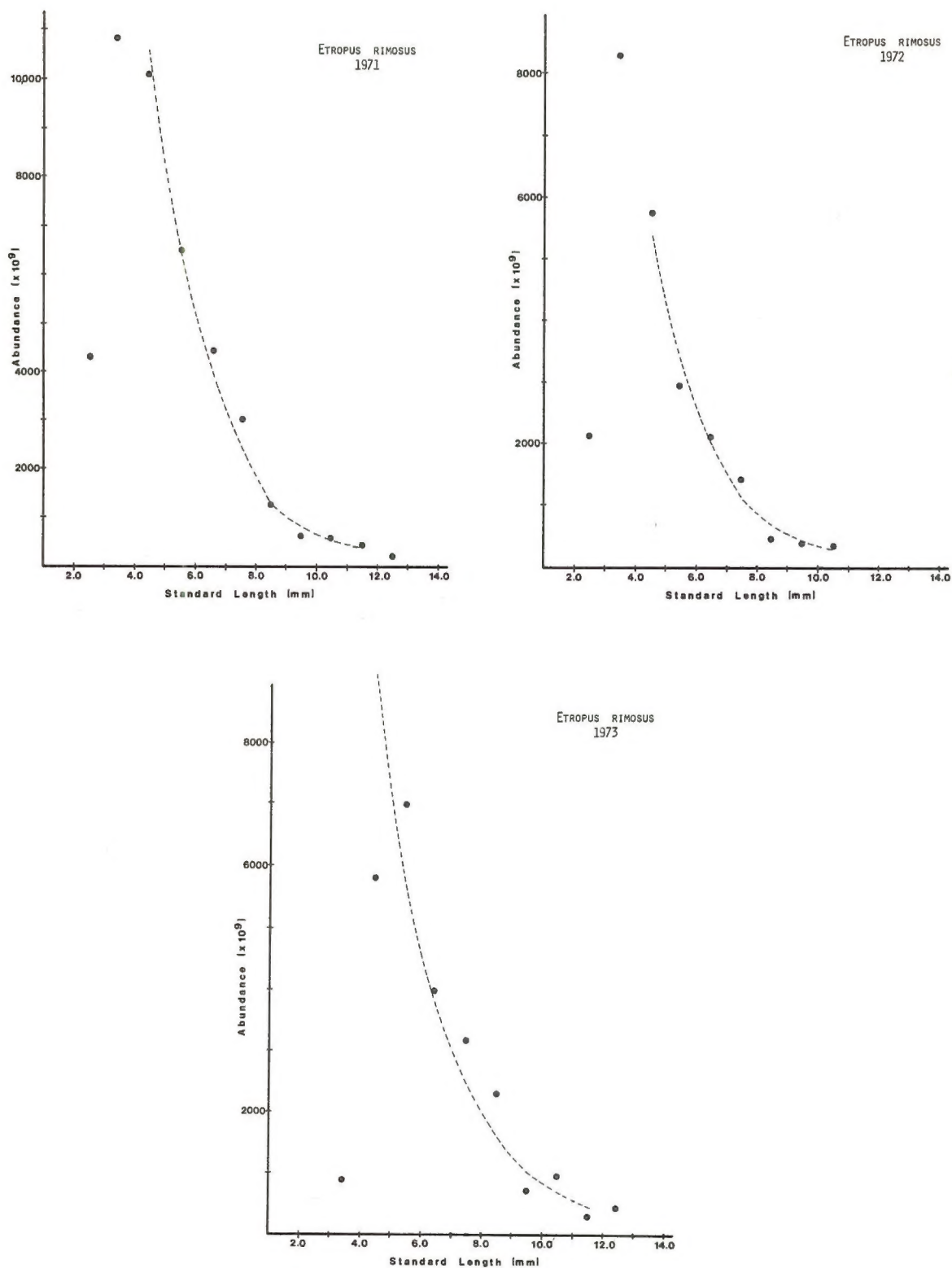


Fig. 172 Apparent mortality rates of Etropus rimosus larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

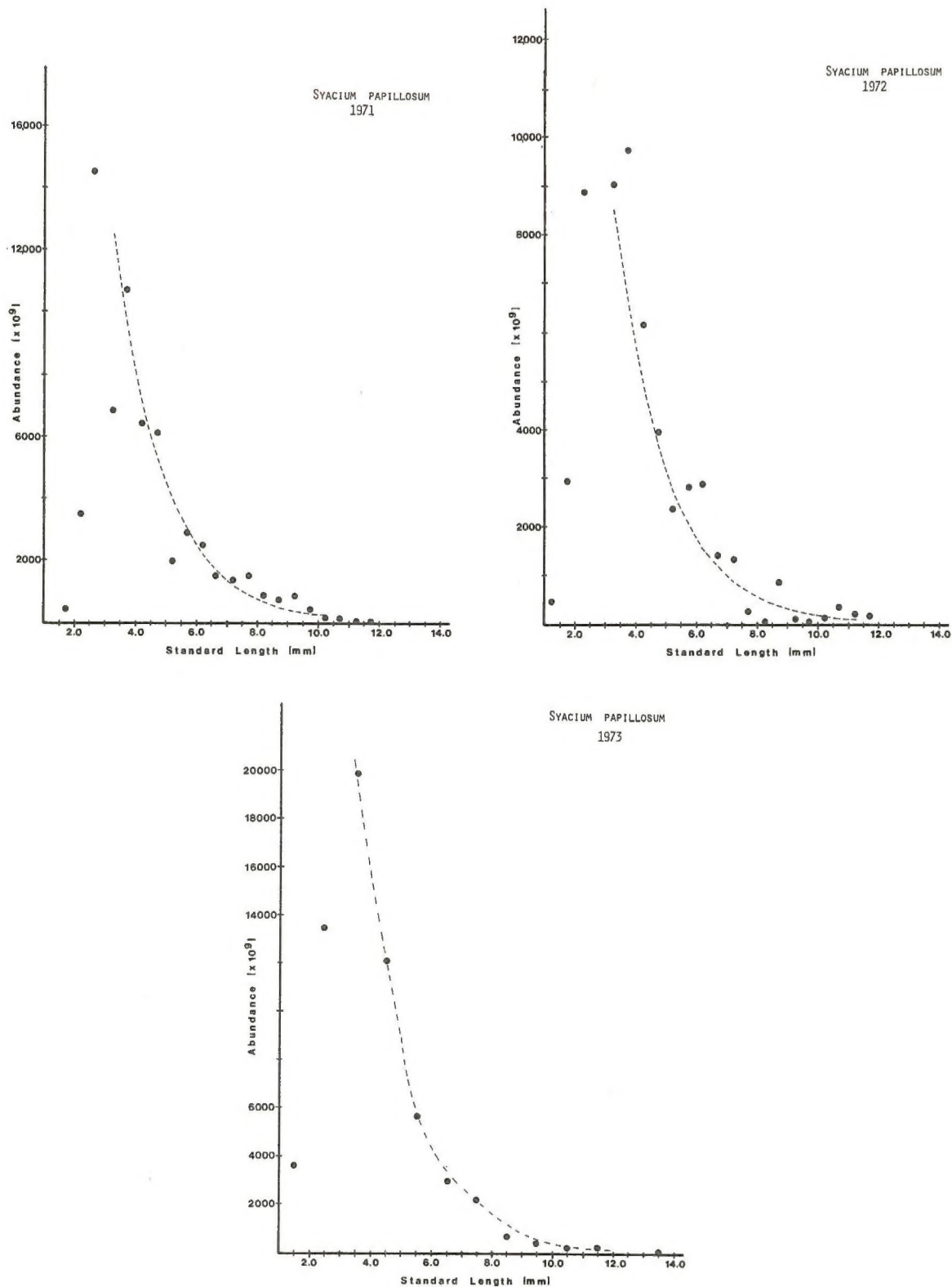


Fig. 173 Apparent mortality rates of Syacium papillosum larvae, collected on ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

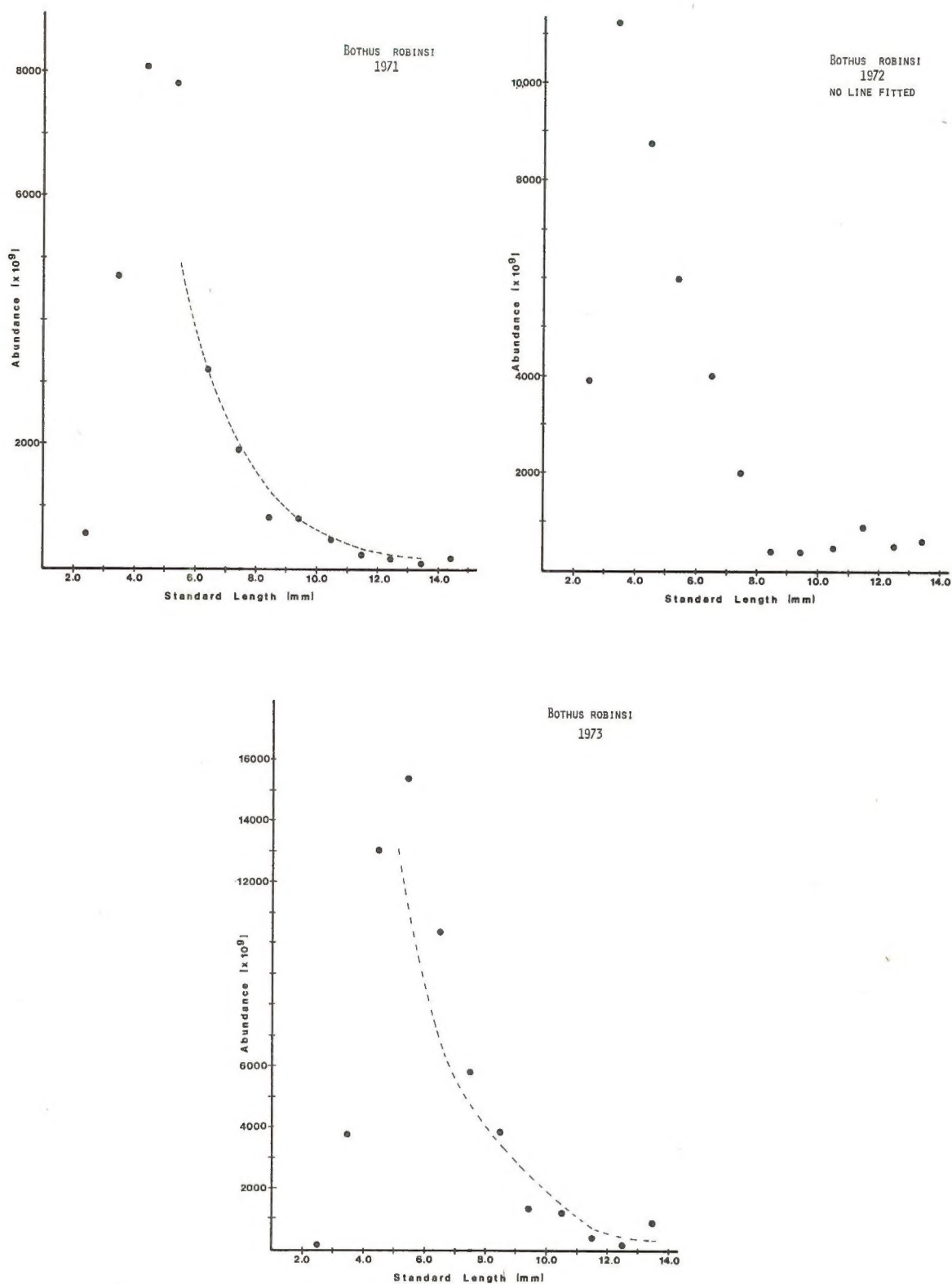


Fig. 174 Apparent mortality rates of Bothus robinsi larvae, collected on ichthyoplankton cruises to the eastern Gulf of Mexico, 1971, 1972 and 1973.

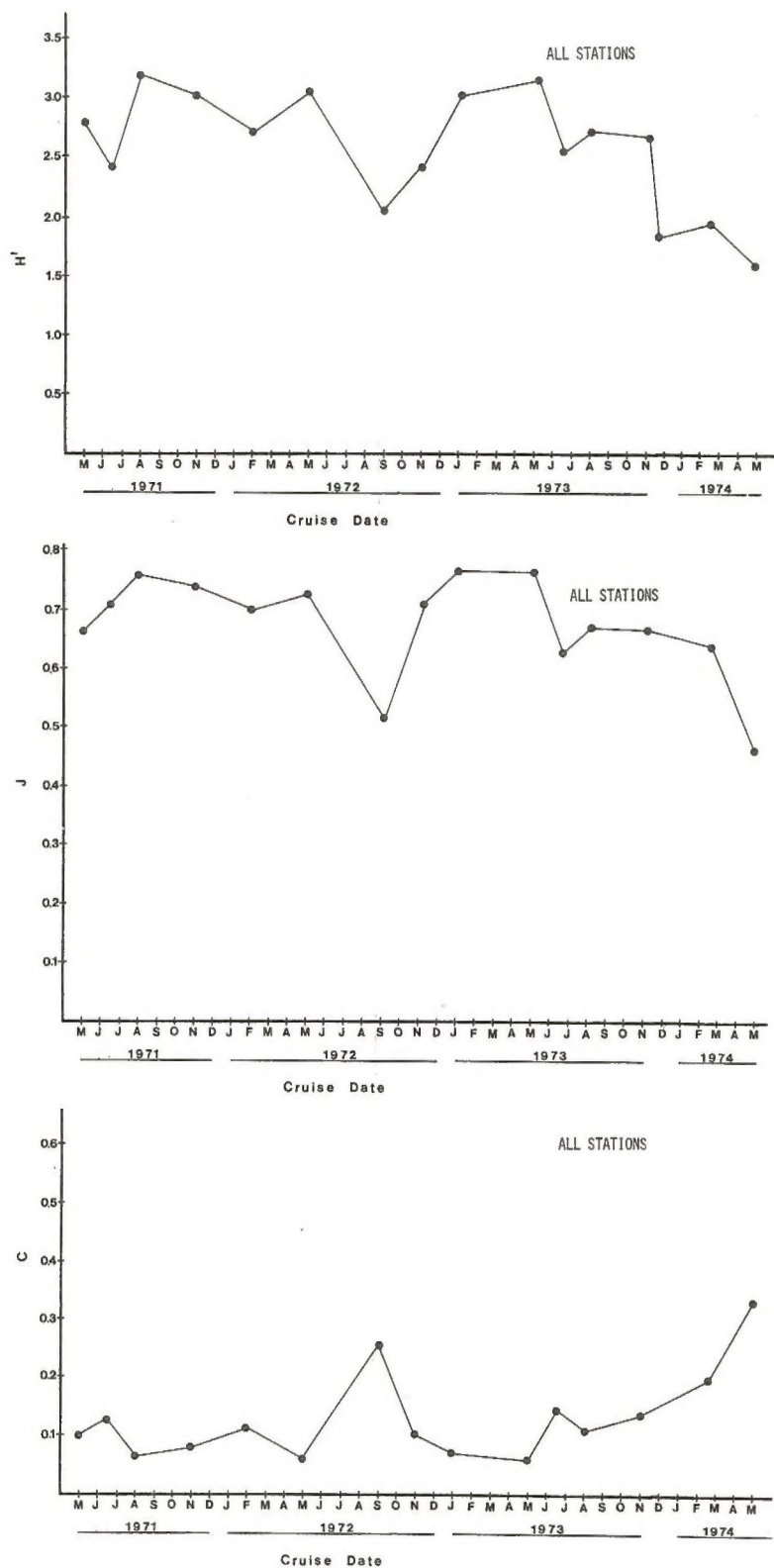


Fig. 175 Values of Shannon-Weaver (H'), evenness (J) and Simpson (C) indices of diversity for ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974. Cruise GE7210 was omitted because only 13 stations were sampled.

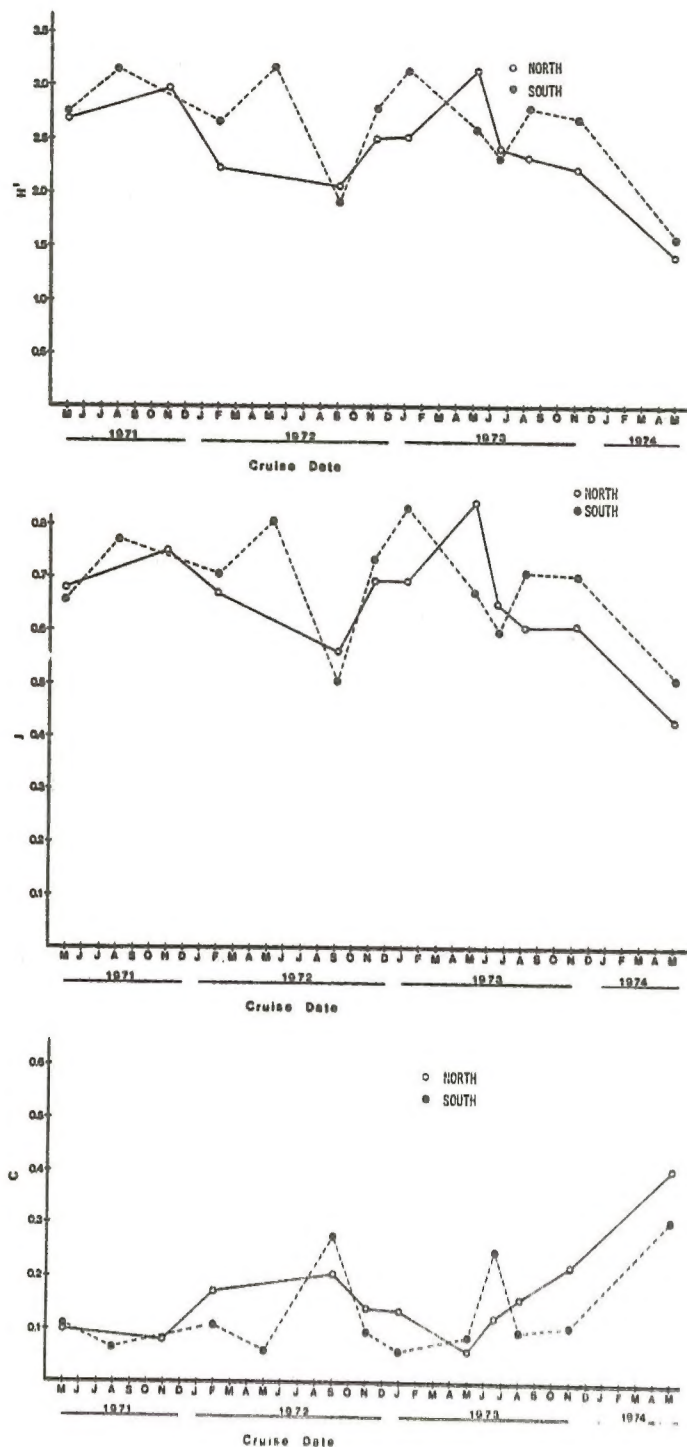


Fig. 176 Values of the Shannon-Weaver (H') evenness (J) and Simpson (C) indices of diversity in North and South sectors for ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974. The North sector includes stations on and north of latitude $27^{\circ}15'N$. The South sector includes stations south of that latitude.

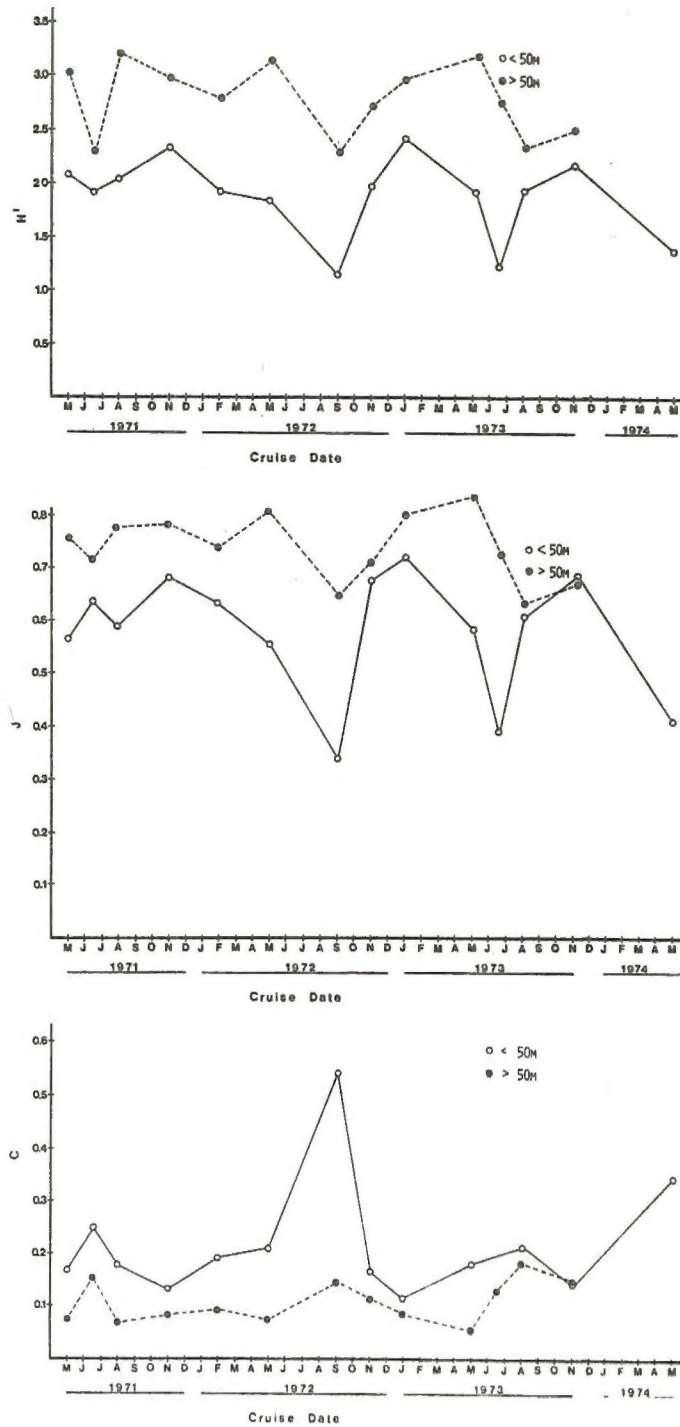


Fig. 177 Values of the Shannon-Weaver (H') evenness (J) and Simpson (C) indices of diversity in $< 50\text{ m}$ and $> 50\text{ m}$ deep zones for ichthyoplankton survey cruises to the eastern Gulf of Mexico, 1971-1974.

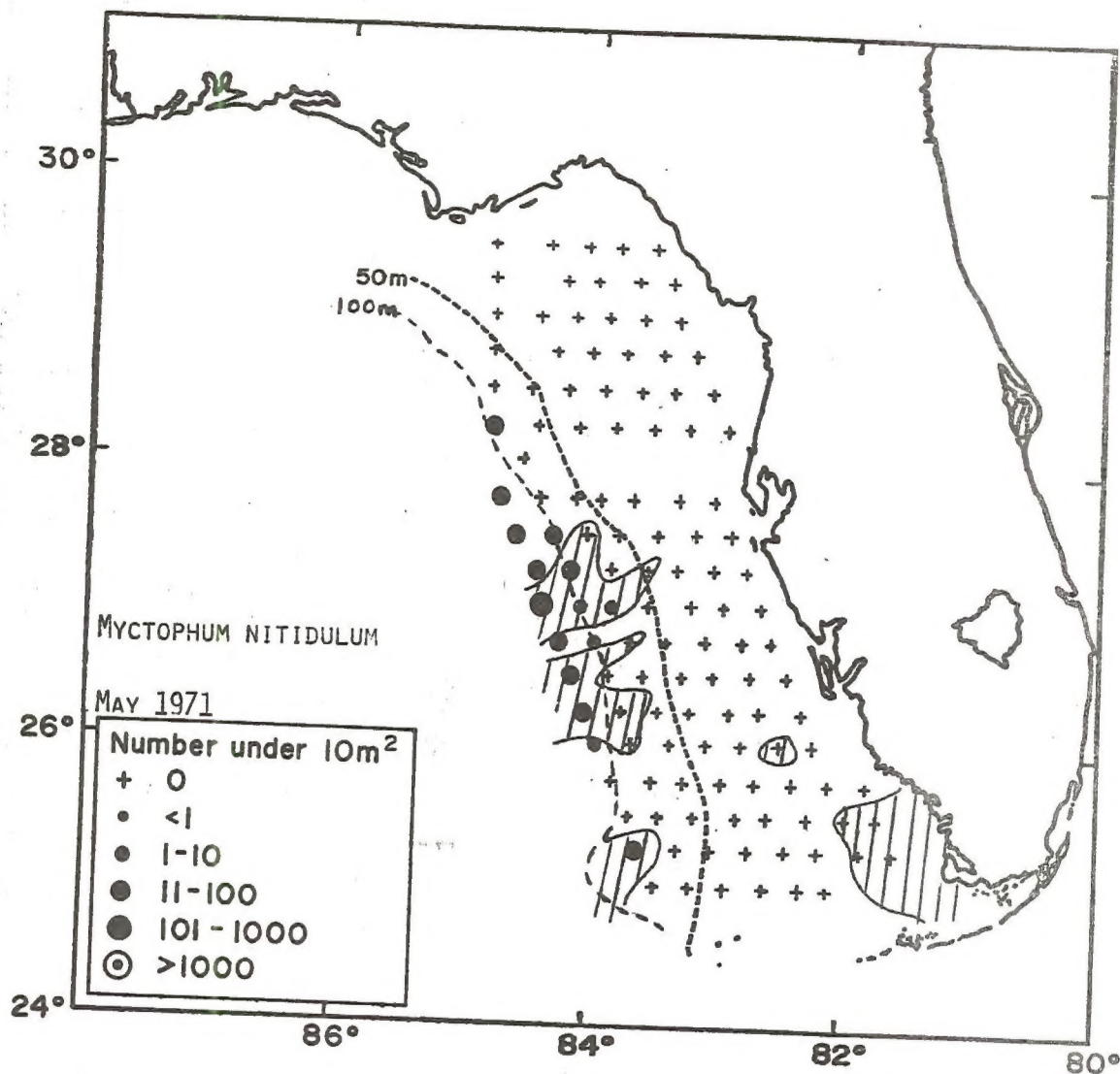
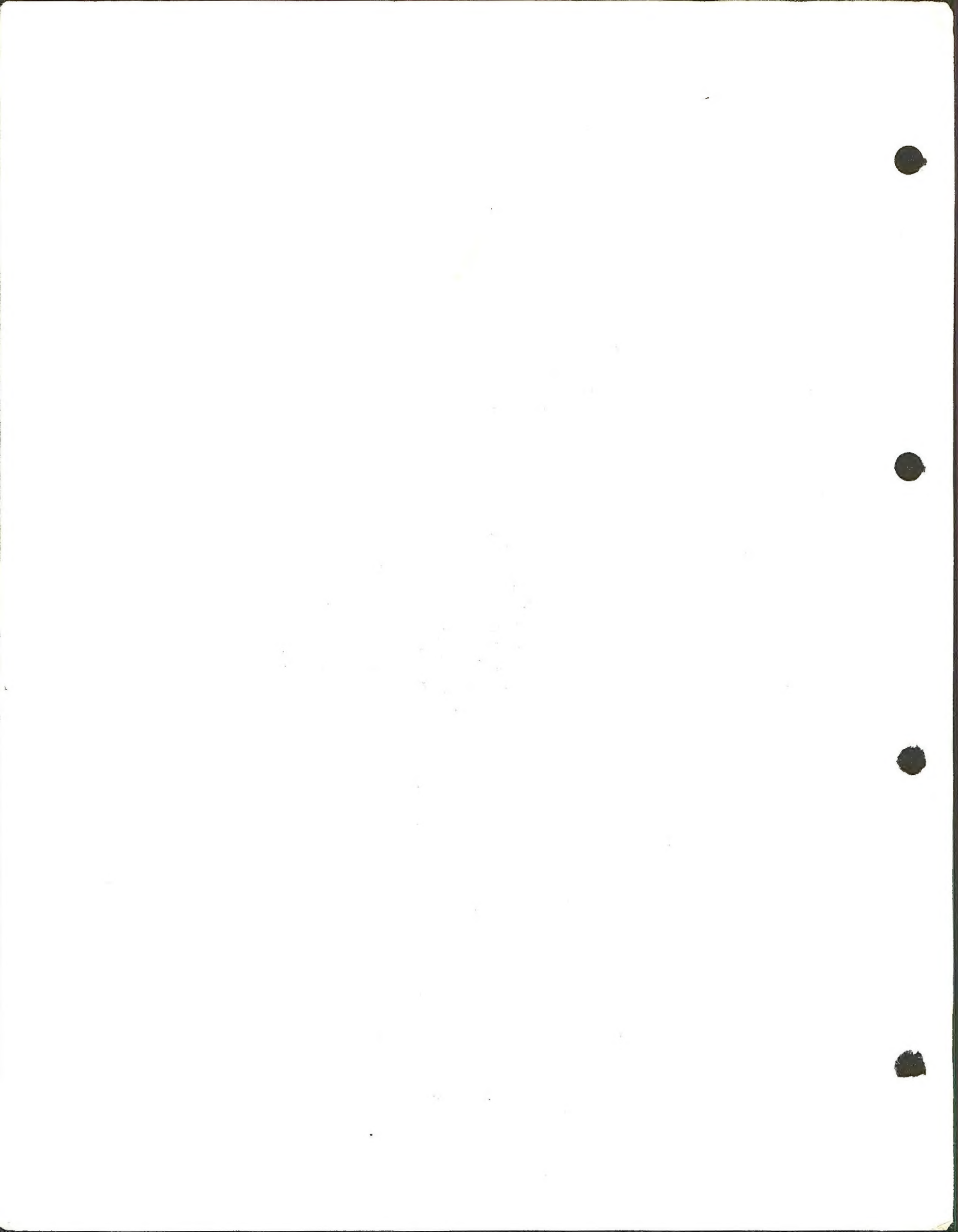


Fig. 178 Occurrences and abundances of *Myctophum nitidulum* larvae in relation to the presence of ≥ 36.5 ‰ salinity water. Hatched areas are those where ≥ 36.5 ‰ water was present. The area near shore and east of 82°W longitude, which has ≥ 36.5 ‰ water, shows the influence of high salinity Everglades estuarine water. Other areas with ≥ 36.5 ‰ salinity show potential presence of Loop Current water.



s Card

on abundance and diversity
in Gulf of Mexico.

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DSC 1279-3a (Feb. 1977)

